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Thirty-Sixth Annual Report

OF THE

Entomological Society

OF

ONTARIO

1905.

(Published by the Ontario Department of Agriculture, Toronto.)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

TORONTO:
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WARWICK BRO'S & RUTTER, LIMITED, PRINTERS,
TORONTO.

To the Honorable WILLIAM MORTIMER CLARKE, K.C.,
Lieutenant-Governor of Ontario.

MAY IT PLEASE YOUR HONOR:

The undersigned begs to present herewith for the consideration of His Honor the Report of the Entomological Society of Ontario for 1905.

Respectfully submitted,

NELSON MONTEITH,
Minister of Agriculture.

TORONTO, 1906.

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To the Honourable Nelson Monteith, Minister of Agriculture:

SIR,—I have the honour to present herewith the Thirty-sixth Annual Report of the Entomological Society of Ontario, which contains the proceedings of the Forty-second Annual Meeting of the Society. By kind invitation of President Creelman, this was held at the Ontario Agricultural College, Guelph, and was one of the most successful and interesting in the annals of the Society. The following Report contains a full account of the proceedings, the papers read and discussed and the reports of the various Officers and Branches of the Society. Two new Branches have been formed during the present year, one in British Columbia and the other at Guelph, and large additions have been made to the membership.

The *Canadian Entomologist*, the monthly magazine of the Society, has been regularly issued during the year, and has now completed its thirty-seventh volume, containing no less than 428 pages.

I have the honour to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Editor.

LONDON, Ontario.

Entomological Society of Ontario.

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Entomological Society of Ontario.

ANNUAL MEETING.

The forty-second annual meeting of the Society was held, by kind invitation of President Creelman, at the Ontario Agricultural College, Guelph, on Wednesoay and Thursday, October 18th and 19th. Owing to the unavoidable absence of Mr. John D. Evans, President of the Society, the chair was taken by the Vice-President, Dr. James Fletcher, Dominion Entomologist and Botanist, Ottawa. Among those present were: Rev. Dr. Fyles, Quebec; Mr. H. H. Lyman, Montreal; Mr. C. H. Young, Hurdman's Bridge; Mr. Arthur Gibson, Ottawa; Mr. C. C. James, Deputy Minister of Agriculture for Ontario; Messrs. J. B. Williams and C. W. Nash, Toronto; Mr. G. E. Fisher, Burlington; Rev. Dr. Bethune, London; President Creelman, Professors Lochhead, McCready, Sherman, Hutt, Reed, Messrs. Zavitz, Barlow, Jarvis, Hotson, Klugh, and others, Guelph. There were also present a large number of the young women students from the Macdonald Institute and of young men from the Agricultural College. At some of the meetings the attendance was over one hundred. The Society was also favored with the presence of Professor John B. Smith, State Entomologist of New Jersey, and a Professor in Rutger's College, one of our honorary members.

During the first morning a business meeting of the Council was held, at which the Treasurer's report was received and adopted. Application was made by a number of gentlemen belonging to the Agricultural College and the Wellington Field Naturalists' Club for the formation of a Guelph Branch of the Entomological Society of Ontario. The request was very heartily acceded to, and the Branch was inaugurated with an initial list of twenty-four members.

Professor T. D. A. Cockerell, of the University of Colorado, Boulder, Colo., an eminent entomologist, especially distinguished by his work in the Coccidæ and Hymenoptera, was unanimously elected an honorary member.

The members of the Society from a distance were very hospitably entertained at luncheon by President Creelman.

In the afternoon Dr. Fletcher took the chair at 2.30 o'clock, and called upon the Directors of the Society to read their reports on the noteworthy insects of the year in their respective divisions. The reports for the first three Divisions were read, and Mr. Fisher explained his inability to prepare a report for Division 4 owing to the pressure of business during the summer months. Prof. McCready also had no report to make for Division 5, as he had removed from London to Guelph before the opening of the season, but his place was filled by Dr. Bethune.

REPORTS ON INSECTS OF THE YEAR.

Division No. 1—Ottawa District. By C. H. Young, Hurdman's Bridge.

Like the two preceding years, the season of 1905 has not, in the Ottawa District, been marked by any serious outbreaks of injurious kinds of insects.

Early in the season the Red-backed cutworm, *Paragrotis ochrogaster,* was

very bad in gardens at Meach Lake, Que., being particularly destructive to onions, peas, cucumbers, vegetable marrow, and broad beans. These caterpillars were extremely abundant in one garden which I was observing, and some evenings I killed as many as 150 and 200 specimens. Poisoned bran-mash was applied, and while this must have done some good, still the cutworms were so numerous that almost every green garden crop was eaten.

The Onion Maggot, as far as I observed, was not nearly so prevalent this year as it was in 1904. Dr. Fletcher tells me that this season he has had success with the Cook carbolic wash. In years of bad infestation nothing, however, acts as a perfect remedy.

Tent caterpillars were slightly more numerous in 1905 than they were in 1904, and it would seem as if these troublesome insects are again on the increase. Everyone can do something to lessen the numbers of these caterpillars by cutting off, whenever seen, the unsightly tents and trampling upon the contained larvæ.

An insect which has been rather abundant in some orchards in my district, is the Woolly Aphis (*Schizoneura lanigera*) of the apple. (Fig. 1.) The large snowy deposits on the limbs and trunks of trees are quite conspicuous and when seen should be destroyed. This can be done in most instances if the trees are not too large, by brushing the clusters off with a whisk, or some other such instrument, dipped in kerosene emulsion, or even pure coal oil. The Woolly Aphis on the alder has also been more than usually abundant this year around Ottawa, some trees being almost wholly covered with these insects. The Woolly Aphids on the alder are interesting on account of the larvæ of *Feniseca tarquinius* feeding upon them. This year these larvæ were quite abundant among these Woolly deposits, and I have brought some of the curious chrysalids to show here at this meeting. The larvæ of Syrphus flies were also busily engaged feeding upon the Woolly Aphids.

Young strawberry plants were destroyed in spring by White Grubs, the larvæ of the well-known June Bugs. They seemed to be very abundant the past season.

In apple orchards, in which spraying had not been practised, Codling Moth caterpillars did serious harm. In some orchards fully half the crop of apples was destroyed. In the Ottawa District, I feel sure, however, that owners of orchards are realizing more and more every year the value of spraying their trees to protect them from insect and fungous enemies.

Red currant bushes were defoliated in some gardens by the well-known Currant Saw-fly larvæ. As it does not take these larvæ very long to strip a bush of its foliage, as soon as they are noticed a remedy should at once be applied. There are two broods of this insect in the season. The remedy for the first one is to spray the bushes with a Paris green or some other arsenical solution. For the second brood, which appears later in the season when the fruit is formed, white hellebore should be dusted on to the bushes.

On some radish plants in my garden at Hurdman's Bridge this autumn, which had gone to seed, I noticed a great number of specimens of the Zebra caterpillar (*Mamestra picta*) (Fig. 2). As I was away at Meach Lake during the summer, I have not been able to find out yet whether they did any serious damage in turnip fields, etc., near by. The Birch Bucculatrix (*B. Canadensisella*) was very bad on white birch trees at Meach Lake, the leaves having a scarred appearance, and falling prematurely from the trees. The insect did not occur on birches nearer to Ottawa.

Fall Webworm was also noticeably abundant in September on forest trees and in orchards. This insect is such an easy one to destroy in orchards that it is a wonder to me owners do not cut off the colonies of caterpillars when first noticed.

The foliage of many maple trees around Ottawa was this year badly attacked by the Maple-leaf Gall mite, *Phytoptus quadripes*, on numerous fine trees, the leaves being conspicuously distorted by the galls made by this tiny mite.

I have brought to the meeting a collection of Micro-Lepidoptera which I have made at Ottawa and Meach Lake during the past two seasons. This year I have mounted up nearly 1,500 of these small moths. I have also brought some interesting larger moths, which are rare in the Ottawa District.

Division No. 2—Midland District. By C. E. Grant.

This has been a fine year for the entomologist, many species appearing in numbers surpassing anything seen since 1898, and whilst that was the case with some species, very little injury has been noticed or reported to me from injurious insects. Of course the Codling moth (*Carpocapsa pomonella*), the Potato-beetle (*Doryphora decemlineata*) are always with us, and Onion Maggots (*Phorbia ceparum*) and the Cutworms of various kinds were also plentiful *Mamestra arctica* in particular. I again note the scarcity of the imported Currant-worm (*Nematus ribesii*), the Tent-caterpillars (*Clisiocampa Americana* and *disstria*) and also the Tomato Hawk-moth (*Proptoparce celeus*). The Cottony Maple Scale was noted on the maple trees, but not in unusual quantities; Asparagus-beetles have not reached us yet. No complaints were received of the Pea-weevil. The Tussock moths were abundant this fall, *Antiqua* being by far the most plentiful.

I have added a lot of new moths to my collection not yet identified. The following I recognized, namely, *Macronoctua onusta*, *Panchrysia purpurigera*, *Hadena ducta*, *Perigea vecors*, *Remigia repanda*, *Prothymia rhodarialis*, *Marasmalus inficita*, *Noctua jucunda*, *Ancyloxypha numitor*, and a new Plusia, making twenty-one species of this genus taken in Orillia.

Butterflies were very numerous, *Grapta J. album*, *Vanessa antiopa*, *Pyrameis cardui* and *huntera*, and *Atlantis* very much more so than ever before noticed. The Geometrids were also very much in evidence; among several new ones mention might be made of *Phasiane Orilliata*, *Macaria glomeraria*, *Plagodis alcolaria*, and *Philereme Californiata*.

On October 14th I took *Remigia repanda*, *Aletia argillacea*, *Xylina antennata*, *Orthosia ferruginoides*, and *Scopelosoma tristigmata*.

Division No. 3—Toronto District. By J. B. Williams, Toronto.

I was not well enough during the past summer to do much entomological work, so that my observations on insect pests have been confined mainly to the ravages of the Grey Tussock moth (*Hemerocampa leucostigma*) on the shade trees in the streets of Toronto. (Figs. 3 and 4.) They were very numerous this year, especially on the horse-chestnuts.

The city authorities spent some money in the collection of the egg masses during the past winter, but there are so many infested trees in private grounds that the destruction of eggs on shade trees only cannot effectually check them. There are eight chestnut trees on the grounds in front of the house where I live, some of which were partially denuded of their foliage by these caterpillars. Towards the middle of July, while sitting under these trees, one could hear a continual patter on the grass as the creatures dropped themselves down from the branches; and quite an army of them were creeping about the ground for several days, while they sought for places to pupate. Females emerged and began to lay eggs about the 5th of August.

I offered a small sum to several boys on the street if they would clear the cocoons off those eight trees. Some of them were good climbers, and they collected, I believe, about two buckets full. The trees are now, apparently, free from them, and it will be interesting to observe next season to what extent this clearing has been effectual, for there are no other chestnut trees near them.

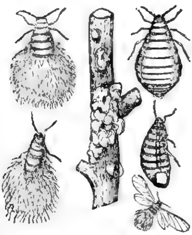

Fig. 1. Woolly aphis of the apple; much enlarged, except twig.

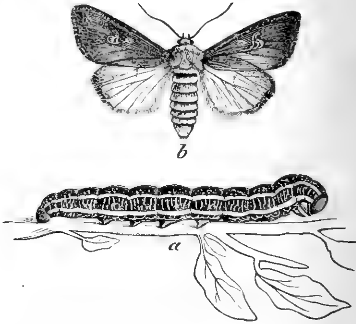

Fig. 2. *a* Zebra caterpillar, *b* the moth, Mamestra picta.

Walking-stick insects (*Diapheromera femorata*), which were so numerous in some localities last year, have only appeared this year in about their ordinary numbers.

Tent caterpillars, as far as I have noticed, have been comparatively scarce around Toronto, and Dr. Brodie's observations also confirm this statement.

I heard one complaint of apples, from a garden north of the city, having worms in them, but I had no opportunity to examine any of them.

Division No. 5—London District. By C. J. S. Bethune.

At the request of Professor McCready, whose appointment to the chair of Nature Study at the Macdonald Institute, Guelph, caused his removal from London last winter, I beg to make a report upon the noteworthy insects of the past season in that part of the country.

In the city of London itself public attention has been especially drawn to the widespread abundance of the Cottony Maple Scale (*Pulvinaria innumerabilis*, Rathv.) on the shade trees of the streets and boulevards of the city. (Fig. 5.) On the maple and basswood trees especially it was to be found in countless millions, and the cottony tufts of egg-masses on the underside of twigs and branches were so numerous and so close together as to look as if the boughs had been thickly spattered with whitewash. Towards the end of August the leaves on many trees were curled and withered from the continuous drain of the scale insects and began to fall prematurely; in some instances the trees were almost bare by the first of September. Grape vines, the Boston ivy, Virginia creeper, and many shrubs were included in the attack, and injury was also caused to plants and flowers by the constant drip of "honey dew" and the black fungus that grew wherever it fell. This attack has been going on for some years and steadily increasing in extent, and now it seems to have reached its culmination, and, we may hope, may begin to decline. Two years ago at our annual meeting, I gave an account of this

insect and an outline of its life history; as this was published in our Report for 1903, it is unnecessary to go over the same ground again. In September last the Park Superintendent and one of the aldermen asked the local members of the Society to report upon this insect and the Tussock moth to the City Council. This was accordingly done, and on the 2nd of October we attended at the City Hall and were invited by the Mayor to present any report we had to make.

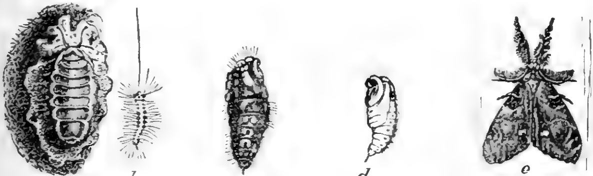

Fig. 3. Tussock moth: *a* wingless female moth on its cocoon; *b* young caterpillar; *c* chrysalis of female; *d* of male; *e* male moth.

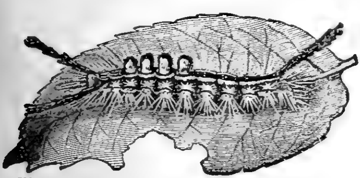

Fig. 4. Tussock moth: full-grown caterpillar.

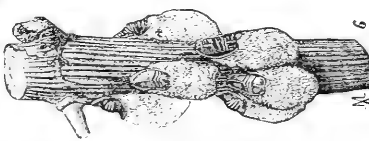

Fig. 5. Cottony maple scale; female scales with tufts containing eggs.

The Tussock moth (Figs. 3 and 4) was the subject of newspaper articles in the local press from time to time during the summer, and fears were expressed that, as it was very destructive in Toronto and doing some injury in Hamilton, it might soon reach London. We were able to assure the City Council that this dreaded insect had been well known in London to entomologists for thirty or forty years, and that during the past summer it had been as plentiful as usual. It was not, however, numerous enough to be a cause of any alarm, and no injury to the trees of the city could be charged to it. A simple method of preventing its increase was suggested and will no doubt be carried out, namely, the gathering and destroying during the winter the masses of eggs laid by the wingless female moth on her cocoon. These are white and conspicuous and in most cases within easy reach; they are so few in number that any householder could clear the trees on his own premises in a few minutes, and the work of removing them from the city trees would involve but little labor. It was recommended that only the cocoons bearing egg-masses should be destroyed, as the others contained either empty male chrysalids or parasites.

With regard to the Cottony Maple Scale, we were unable to suggest any practicable remedy. Two methods of dealing with the insect were mentioned as worthy of adoption by anyone who wished to protect his own trees: first, the spraying of the trees during the winter with the lime and sulphur wash that is found so effective in the case of the San Jose Scale, in order to destroy the female scales that winter on the twigs and branches of the trees; and secondly, by spraying of the trees with kerosene emulsion towards the end of June and during the first two weeks of July three or four times in all—in

order to destroy the lice when they are hatched from the egg-masses and are moving about in search of a final resting place. At this particular time they are exposed and can be reached by spraying, but as soon as they attach themselves to the leaves and become covered with their scale they are practically invulnerable. The Park Superintendent was instructed to try these methods on selected trees and report results next year, but it was felt to be beyond the power of the city authorities to deal with the immense number of shade trees throughout the city, unless they were quite sure of exterminating the pest.

By way of encouragement I mentioned to the Council that this insect is well known in many cities in the United States, and the general experience has been that after a few years of abundance it ceases to be numerous for a time owing to the attacks of parasitic insects and the effects of atmospheric conditions. It does not, as a rule, kill the trees, because its attacks do not strip off the foliage nor entirely prevent the leaves from discharging their function, though when so numerous as at present they must certainly impair the vigor, if not the vitality, of the trees they infest. As an illustration of their numbers, I may mention that on a single maple leaf picked at random from a tree I counted 707 scales on the under side and 72 on the upper surface. When we consider the number of leaves on a large tree, the majority of which are infested the specific name *innumerabilis* seems most appropriate.

There were several other insect attacks during the year that may be mentioned, but they did not attract public attention.

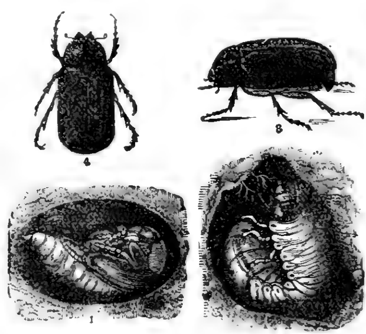

Fig. 6. May beetle: 1 pupa, 2 the white grub, 3 and 4 the beetles.

White grubs (larvæ of *Lachnosterna* or May Beetles) (Fig. 6), were complained of in some cases both in Woodstock and London on account of the damage they had done to lawns by devouring the roots of the grass. As they work underground and spend three years in the larval state, it is not easy to prescribe a remedy. In the case of old pasture fields, where they sometimes become very abundant, a simple remedy would be to plough up the sod and turn in pigs or turkeys, and then to grow a root crop. Where lawns are badly damaged it would be worth while to dig up the affected parts late in the autumn and expose the grubs to the frost, or during the summer to remove the sod and soak the ground below with coal oil. Subsequently new earth could be filled in and fresh turf laid.

Wire-worms (larvæ of *Elateridæ* or Click-beetles) were very abundant in many market gardens in the neighborhood of London. As these creatures also

work under ground it is difficult to find a remedy that will be effective. Much, however, may be done to reduce their numbers by trapping them. This is done by placing bunches of clover or sweetened meal poisoned with Paris green under shingles or pieces of board where they are troublesome. The insects are in the habit of taking refuge in the daytime beneath shelters of this kind and will naturally partake of the poisoned food they find provided for them.

The 12-spotted Asparagus beetle (*Crioceris 12-punctata*) is becoming each year more and more numerous in gardens about London. The other species, *C. asparagi*, has not yet made its appearance. Dusting with air-slaked lime seems to be the simplest and most effective remedy for getting rid of the larvæ which feed upon the foliage during the summer.

The Fall Web-worm (*Hyphantria textor*) has been somewhat in evidence with its unsightly webs on some trees here and there on the city streets, and on many shrubs and trees in Springbank Park. As soon as the Superintendent's attention was drawn to them, they were speedily got rid of in the Park, but on private grounds many were left unmolested. It is such an easy matter to remove the webs with a stick, and destroy the inmates by trampling under foot, that there is no excuse for neglecting them. It is true that they generally inflict but little damage upon the trees owing to the lateness of their attack, but they are very unsightly and are sometimes very injurious to young trees and shrubs.

The Codling Moth is reported to have been more prevalent than usual this year and to have considerably affected the apple crop about London. The increase of this serious pest is no doubt due to the neglect of spraying, and possibly to ignorance of the fact that there are two broods in the year in this region of country.

The Pea-weevil, on the other hand, is very little complained of, and could be effectually checked if a combined effort were made by all growers and seedsmen. Fumigation with bisulphide of carbon is an easy remedy and not expensive. Its general adoption would soon restore the growing of peas to the valuable position it formerly held in Ontario.

Regarding the Hessian fly, no complaints at all were heard and evidently no appreciable damage was done.

Cutworms, Squash-bugs, Onion and other root maggots were as prevalent as usual and gave the market gardeners much trouble. On the whole the season was not marked by any unusual or violent outbreak of insects, with the exception of the Cottony Maple Scale already referred to.

DISCUSSION OF THE DIRECTORS' REPORTS.

The Tussock moth was the first insect taken up for consideration.

Mr. T. D. Jarvis stated that at St. Catharines and in Toronto eighty per cent. of the cocoons that he examined were parasitized by Pimplas and Chalcid flies.

Prof. J. B. Smith explained that one of these classes of insects was a secondary parasite upon the other, and could not, therefore, be credited with aiding in the reduction of the Tussock moths, but rather the contrary.

Mr. C. W. Nash said that the Tussock moth was by no means confined to cities, as he had found them abundant all through the County of York and even as far away as St. Joseph's Island in Lake Huron. There he had found a female depositing its eggs as late as the 8th of October. His experience was very different from that of Mr. Jarvis, for he had only found one cocoon in 400 parasitized; many, however, were diseased and their contents had become fluid.

Prof. J. B. SMITH had collected many egg-masses and found none that were parasitized. In the southern part of the State of New Jersey there were two broods of the insect in the year, but in the northern part only one. The city of Newark is situated on the dividing line between the life-zones, and consequently there are two broods in part of the city and only one in the rest. Ten cents per quart was paid for egg-masses collected, but he considered spraying with Paris green a much cheaper method of destruction, as it only cost about ten cents per tree, while egg-collecting came to $2.50 when the attack was severe. The egg-masses he found to contain an average of 200 eggs.

Dr. FLETCHER, in reply to a question as to whether spraying should be discontinued in order to avoid killing the parasites as well as the noxious insects, stated that it was much safer to spray and be sure of killing the enemy, especially as there was no certainty regarding the work of the parasites. In answer to a further question, Does spraying kill internal parasites? he replied, Yes, if it destroys the insect which supplies its parasite with food. On one occasion he had found a number of parasites in egg-masses on trees at the corner of King and Simcoe streets, Toronto.

In remarking upon Dr. Bethune's paper, he stated that the Codling Moth was one-brooded from Toronto eastward and two-brooded westward. At Ottawa, where there is but one brood, spraying in the spring is sufficient for its control, but at London the conditions are quite different. For the Cottony Maple Scale he recommended treatment of the trees in winter with the lime and sulphur wash. White-grubs in lawns may be checked by freely spraying the affected portions with kerosene emulsion and then washing with water. Click-beetles, the parents of Wire-worms, are attracted in large numbers to the bait used at night in sugaring for moths, and might be largely destroyed by this means. It was remarkable that the twelve-spotted Asparagus beetle should have outstripped the other species in its advance westward through Ontario; the latter (*C. Asparagi*) was spreading very slowly. The Pea-weevil is at present somewhat scarce and therefore now is the time for a successful fight against it. The growers of peas should not pay five times too much for their seed, because peas infested with weevils only contain one-fifth of their proper contents. The seedsmen are now fumigating their peas, because their customers demand seeds that have been treated with bi-sulphide of carbon,—the method is very simple and should be universally adopted.

Mr. C. W. NASH said that peas should be treated at once after they are harvested, because a large proportion of the weevils emerge from the peas early in October and thus escape fumigation, if it is postponed to a later date. They may be found in immense numbers in barns where peas have been stored.

Prof. J. B. SMITH asked whether the White-grubs referred to by Dr. Bethune were hairy or smooth. On being told that they were smooth and the larvæ of May-beetles (*Lachnosterna*), he said that at Washington a few years ago a lawn was so badly affected by White-grubs, which ate the roots of the grass, that the turf could be rolled up like a carpet; there the grubs were hairy and the larvæ of *Allorhina nitida* (a beetle which does not occur in Ontario).

In New Jersey they had had a similar experience to that in London with the Cottony Maple Scale,—the city of Plainfield last year was the worst affected and the numbers were similar to those described by Dr. Bethune. The large wintering scales of the female he had found abundantly parasitized. A Lady-bird beetle (*Hyperaspis*) was very numerous and attacked the scales,

while its larvæ devoured the eggs in the cottony masses. The parasites became more and more abundant as the season went on, and he had every confidence that there would be little or no trouble from this insect at Plainfield next year. His count of scales was similar, having found from 500 to 800 on a single leaf. Insecticides of various kinds had been tried, but he could find nothing that would kill the insects and not injure the foliage. He had, therefore, resorted to water from the city mains, and found that with a hose the eggs could be washed off the trees if applied when the cottony masses are opening early in May. This is a simple, easy and inexpensive remedy, and one that is ready at hand for every one who has a lawn and hose for watering it. If the scales are higher up than their usual position on the lower branches they can usually be reached with the assistance of a step-ladder.

Mr. C. W. Nash spoke of the damage done to asters and dahlias by the Tarnished Plant-bug (*Lygus pratensis*) and the trouble it gave to florists in Toronto; dusting with Pyrethrum insect powder was recommended as a remedy. He also referred to the prevalence of Hydrœcias (*Gortyna*) this year; he had found them boring into the roots and stalks of rhubarb, dahlias, Rudbeckia, burdock and in fact all plants that were capable of holding them; two species, *Gortyna nitela* and *cataphracta*, were especially abundant.

Dr. Fletcher drew attention to the good work being done by Mr. H. H. Lyman and other entomologists in Montreal in breeding and tracing out the life-histories of these moths. *G. nitela* was of use, as it destroys large numbers of Canada thistles and rag-weed.

THE "TUSSOCKS."

By The Rev. Thomas W. Fyles, D.C.L., F.L.S.

The common application "Tussock Moths," as applied to the perfect insects of the species *Orgyia antiqua*, Linneus, and *Orgyia leucostigma*, Smith and Abbot, (Fig. 7), is a misnomer. It is to the *caterpillars* of these species that the name "Tussock" is properly applied—they are conspicuously *tussocky*, or tufted, along the back, (Fig. 4). The generic name Notolophus given to these insects by Germar signifies this:—*Notos*—the back; *Lophos*—a crest. The male perfect insects of the two kinds have been very appropriately called "Vapourers," because of their airy and uncertain flight. They are known respectively as the "Brown Vapourer" and the "Grey Vapourer." The females of both species are incapable of flight, having only rudimentary wings.

The Greek generic name *Orgyia* was probably given because of the outstretched black pencils extending like arms from the shoulders of the larva. The feminine specific name, *antiqua*, from the Latin, appropriately denotes the grey and hunched form of the female moth. Linneus was often fanciful in his application of names!

The term *leucostigma* was given by Smith and Abbot to the Grey Vapourer on account of its white spots, (Fig. 3e); though the spots on Antiqua are more conspicuous than they, because of their darker setting.

The genus Orgyia belongs to the family *Liparidæ* which, in England, includes some very handsome, and also some very troublesome species. *Psilura monacha*, the "Black Arches," is a remarkably beautiful moth. *Porthetria dispar*, the "Gypsy Moth," is handsome, but its larvæ are destructive; whilst the larvæ of *Europroctis chrysorrhœa*, the "Brown-Moth"

are offensive, not only from their destructiveness, but also from the fact that their barbed hairs are easily cast, and, alighting on the human skin, work their way into its pores, and cause excessive irritation. In my early efforts at raising insects, in England, I again and again experienced the baneful effects of too close contact with these caterpillars.

The story of the introduction of the Brown-tail and Gypsy Moths to Massachusetts has been well told in the publications of Messrs. Fernald and Kirkland and Forbush; and so the evil reputation of these species has been widely spread. People in Canada have looked for their advent with apprehension. It is not to be wondered at, therefore, that when the egg-masses of an allied, but less injurious, species became conspicuous, *to expectant eyes*, something like a panic occurred it was thought that the dreadful *Gypsy Moth* was come.

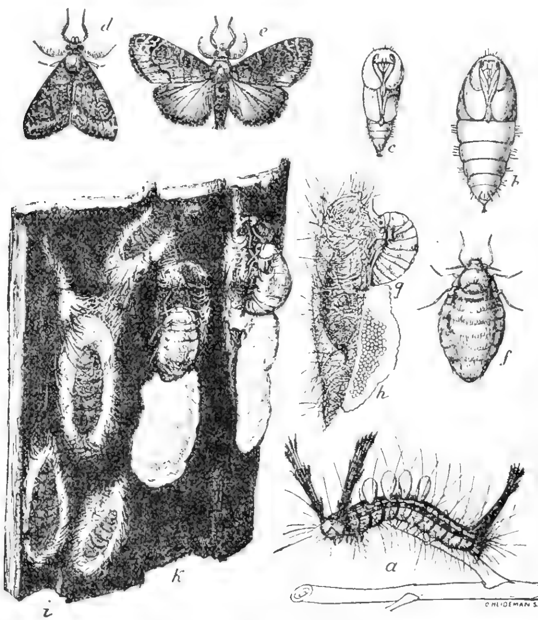

Fig. 7. Tussock moth : *a* caterpillar ; *b* and *c* chrysalids ; *d* and *e* male moths ; *f* and *g* female moths ; *h* eggs ; *i* male cocoons ; *k* female moths and egg-masses on cocoons.

I have known both the Brown Vapourer and the Grey for many years. The former, indeed, attracted my attention soon after my arrival in Canada; for it was to me an old acquaintance. Both species are common at Quebec. *Leucostigma* has been plentiful here for some years past—it has never done noteworthy damage. Its favourite food here is the White Willow (*Salix alba*, Linneus); and patches of its eggs may at this present time (October, 1905), be seen on the bolls of the willows in the Custom House Square, and along Mountain Hill.

I have always regarded the larvæ of *Antiqua* and *Leucostigma* as harmless and very beautiful objects—creatures to be admired. I certainly read with amused surprise the following paragraph in the "Montreal Daily Star" of July 22nd last:—

"It is now beyond question that in addition to the caterpillars being very destructive to vegetation, they are also poisonous to human beings. They can let themselves down from a tree by means of a silken thread, similar to that made by the spider. They seem especially to like to get down the back of one's neck, and they certainly do some painful work there."

What a thick skin a man must have who could let a caterpillar alight on his neck, and not brush it off immediately!

Still further to alarm the public, and to show "that our troubles have hardly commenced yet," the writer in the "Star" proceeds to describe the ravages of the *Gypsy Moth* in Massachusetts, and re-produces some of the illustrations from Forbush and Fernald's Report. There is a representation of the Dexter Elm with ten men engaged in freeing it from the eggs of the moth.

There, too, is a picture of the destroying of the eggs in a stone wall by means of cyclone burner.

Both of these are likely to excite apprehension, but are hardly fair to the Tussocks, who were not the guilty parties in the case. "Give a dog a bad name and hang him!"

We remember the "Kissing Bug Scare," in which kissing-bugs multiplied to such an extent that it was hard to believe that any damsel could go unkissed.

In this Tussock Moth Scare, whatever damage has been done to trees, the Tussocks—in popular opinion—have been the doers of it. One man told that the gooseberry bushes in the gardens near him had been defoliated—of course the Tussocks had done the harm, and not *Eufitchia ribearia*, nor *Nematus ventricosus*. The larvæ of *Vanessa Antiopa*, *Clisiocampa disstria*, *Hibernia tiliaria*, *Hyphantria textor*, and others, always do their share towards denuding the trees; but for injuries done by these the Tussocks are now held blame-worthy.

To show how easily a mistake might arise:—A person at Quebec, on the look-out for damage by the Tussocks, would notice that the Ash-trees, which formerly were such graceful adornments to the public squares and gardens of the city, were leafless, dead, or dying. "Oh," he would be likely to exclaim, "the terrible Tussock Moths!" But the Tussocks were entirely blameless in this case. My attention was directed to the trees, in the spring of 1904, by Mr. Joly de Lotbinière. I examined them carefully, and could find no trace of injurious insects. I came to the conclusion that the death of so many of these beautiful trees was occasioned by the excessive drought of the preceding spring.

I had recorded that on the 11th of April, 1903, and again on the 12th, the thermometer in my yard indicated 82 degrees in the shade. The untimely heat was followed by a long, cold, and exceedingly dry time. Prayers for rain were offered in some of our churches.

In the end of May and beginning of June, the air was thick with smoke from forest fires. On the 3rd of June the smoke was so dense that the river steamboat "Frontenac" was unable to run.

I am convinced that the young foliage of the ash trees was so affected by these circumstances that it performed its functions imperfectly. Then, too, the earth was so parched that the roots of the trees must have failed

to extract nutriment from it—the Ash is a tree that requires much moisture! The unfavourable summer was followed by a very severe winter.

To these consecutive circumstances I ascribe the loss of so many of our Ash trees, and not to insect depredations.*

The two Canadian species of Orgyia may be easily distinguished in every stage of their existence.

The eggs of *Antiqua* resemble a cluster of whitey-brown beads; those of *Leucostigma* to a dab of cake-frosting.

The larva of *Antiqua* has a *black* head; that of *Leucostigma* has a *red* one.

The difference in the moths has already been sufficiently shown.

It is impossible that the Tussocks can ever be as destructive as the Gypsy Moth has proved itself. Their females have no wings—they lay their eggs on the cocoons from which they crept. So the advance of the species is slow, and is made by the caterpillars. But the female Gypsy Moth has ample wings; and, though it is heavy with its burden of eggs, it can, and does, take flight for other localities. Its caterpillar, moreover, attains a much greater size, and is more voracious than either of our Tussock larvæ.

The close of the autumn is undoubtedly the season for reducing the numbers of *Orgyia antiqua* and *Orgyia leucostigma*. The egg-clusters of both species may be easily peeled from the trees with the thumb and finger. They should then be thrown into the fire. So the numbers of the creatures can be kept down with ease and without cruelty.

THE TUSSOCK MOTH SITUATION IN MONTREAL.

By Henry H. Lyman, M.A., Montreal, Que.

Until Montreal was visited early last spring by a gentleman from Lincoln Park, Chicago, we hardly knew that we had a Tussock Moth situation in our city. Those of us who know about such things, of course, knew that we had the Tussock Moth, that, like the poor, it was always with us and always likely to be with us. But this gentleman, seeing a good many egg masses on trees, sounded the alarm, and addressed a letter of warning to the President of the Natural History Society, who happened to be a Professor of Botany.

The newspapers took the matter up, and one especially devoted much space and energy to a sensational account of the "arrival" of this much dreaded pest, and, evidently confusing it with the Gypsy Moth, told of the millions which had been spent in the United States in fighting it.

A meeting of the Natural History Society was called to consider the situation, to which the public were invited, and about twenty, all told, responded—the Dominion Entomologist being present to throw light on the subject.

After considerable discussion, a Tussock Moth Committee was appointed which later waited upon the Finance Committee and asked for a grant to be used in fighting the pest. The Committee voted the munificent sum of $100 for this purpose. The Society then offered a bounty of 25c. per hundred for the egg masses (Fig. 7*k*), and the school children began to collect them, and much good was anticipated, as the amount voted would have paid bounties

*The trees were cut down this fall (1905). The wood was found to be perfectly sound—quite free from borers.

on 40,000 egg masses, but the Parks and Ferries Committee of the city council took alarm. Here were no less than one hundred good dollars slipping through their fingers to a purely disinterested society, and being honestly expended for the good of the city without the slightest chance of patronage on their part—which was, of course, intolerable. So they demanded the money, and took over the campaign themselves, withdrawing the bounty, and, instead, putting men to work with poles with tin triangles on the ends to scrape the cocoons off the trees and let them lie where they fell.

A certain amount of scraping was, of course, done, but I doubt if we got more than $50.00 worth for the $100.00 expended. The work was begun late, and done much too leisurely, and had it not been that the eggs were unusually late in hatching, would have been even less effective than it was.

In spite, however, of the inefficiency of the work, no very serious damage resulted. A few isolated trees were stripped of their leaves, and a good many trees had at least a part of their foliage rendered pretty ragged, but a very large number of trees were hardly affected at all.

In the grounds about the house where I live there are many trees—silver maples, elms, horse chestnut, butternut, black cherry—and a careful search early in the season only resulted in my finding two egg masses and one female cocoon from which the imago had never emerged. This was removed from the tree and placed in a glass-bottomed pill box, and later there emerged from it over a hundred parasites which, on being submitted to Dr. Ashmead, were pronounced *Diglochis omnivora*, Walker, which I was informed was not previously known to be a parasite of *Orgyia Leucostigma*.

Before the time for the eggs to hatch, I selected a few cocoons with typical egg masses, and immersed them for about ten minutes in gasoline, which I thought would kill the eggs, intending later to place one of them with an inflated larva with the moths in my collection. Fortunately, I did not do so at the time, as I found later that many of the larvæ had hatched, though perhaps some of the eggs were killed by the gasoline bath.

As the caterpillars of the Tussock moth matured and the damage to the trees became quite evident, the city fathers took alarm for fear there might be a second brood which would be much more destructive than the first, but they were assured by the official entomologist that there was no danger of that. There must, nevertheless, have been a few eggs which hatched, as Mr. Winn reported seeing a few days ago nearly mature larvæ crawling around, and a newly emerged female ovipositing. The numbers were, however, too insignificant to cause any further appreciable damage.

A Bank manager, knowing the nature of my business, applied to me for a "prescription" to clear out the pest from his trees, but when I told him that it was never possible to exterminate an insect pest, that all we could do was to control it, and recommended careful, hard and continuous work in removing the egg masses from his trees, I am afraid that he thought that there was not much good in entomology.

The Parks and Ferries Committee decided to apply to the Finance Committee for a grant of $500.00 for further work in removing the egg masses this autumn, but I have learned from the Secretary of the former committee that only $200.00 was granted, and that this wholly insufficient grant has been nearly all expended.

In this matter, however, I think we are likely to derive nearly as much benefit from the action of natural causes as from the efforts of man. Probably owing to the frequent rains, bacterial disease broke out among the caterpillars when approaching maturity, and many were seen hanging limp and rotten from this cause.

Of a number of cocoons which I gathered for Dr. Fletcher many were found to be putrid, and I have seen many cocoons, apparently of females, from which the moths had evidently not emerged.

In view of the preparation of this paper I devoted a few hours recently to a necessarily rapid and very cursory examination of the shade trees in some of the principal uptown streets and squares, as well as making inquiries among my entomological friends. I ascertained that on one street a horse-chestnut in a garden had been quite stripped, but that it had leafed out again and had even blossomed a second time. I examined it, and found that it was an old and decrepit tree. In the same garden there is a specimen of what used to be called *Negundo Aceroides*, but now *Acer Negundo*, L. (the Ash-leaved Maple), which had also been stripped, but a few yards further up on the opposite side of the street were Horse-chestnuts and Ash-leaved maples which had practically not suffered at all.

We have very few Horse-chestnuts in Montreal, and practically none on the streets, nearly all the trees set out in the streets being maples and elms. But Acer Negundo, where attacked, seemed to suffer more than any other tree. The examination I made disclosed only a few trees very seriously infested, but very many trees were found which had a few egg masses upon them.

A few egg masses were found on telegraph poles, and, as I suggested to Dr. Fletcher, if the caterpillars could be induced to eat them they would be the greatest possible blessing to our city.

It is greatly to be deplored that the Finance Committee voted so inadequate an amount, as had the full $500.00 been granted a great deal more work could have been done, and as the species has only been increasing slowly of recent years, if all the egg masses which could be found were destroyed, it would probably be years before any further expense would have to be incurred; but doing the work in only a half-hearted way will necessitate its being done every year if our shade trees are to be protected from damage.

No depredations by this pest were perceptible in the district surrounding Montreal, and the damage to the shade trees in the city is, doubtless, to be attributed to the greater immunity of the caterpillars from their natural bird and insect enemies.

ENTOMOLOGICAL CONDITIONS IN NORTH CAROLINA.

By Franklin Sherman, Jr., Professor of Entomology and Zoology, O.A.C., Guelph.

North Carolina is a State of approximately the same area as "Old Ontario," approximately the same length, and approximately the same population, and lies directly south of Old Ontario, Ottawa being almost precisely north of Cape Hatteras, and Windsor north of Murphy, the western-most county seat. At its eastern end the State is some 150 miles broad, across the middle something like 100 miles, and tapers to a dull point at the south-western extremity. In fact, the State is somewhat slipper-shaped.

The population is more evenly distributed than in Old Ontario, there being no large region so thinly settled as the northern section of our province, and no large region so thickly settled as the southern section. There are no large cities, Wilmington, the largest, having but 25,000 population, and Raleigh, the capital, having 13,000, almost exactly the size of Guelph. From these facts it is easy to conclude (and rightly) that agriculture is the chief

occupation in all parts of the state, far out-ranking all other industries combined in the amount invested and in returns. The abolition of slavery forty years ago left these people poor, and many of the large plantations were abandoned, while, as a rule, the farms are still too large to be cultivated to best advantage. An abundance of cheap, inefficient and generally ignorant labor, and a scarcity of intelligent and reliable help, has had a very detrimental effect. In all parts of the state, especially east of the mountains, may be seen abandoned farm lands, and occupied lands which are poorly cared for. These facts all influence the entomological conditions prevailing.

Geologically, the state is very distinctly divided into three great regions:—*1st*, the Eastern, or coastal plain region, extending from the coast to about 100 miles inland to an elevation of 300 feet. *2nd*, the Middle, or piedmont region, extending from the coastal plains region to the foot of the mountains, a belt some 150 miles in width, ranging from 300 to 1,000 feet elevation. *3rd*, the Western, or mountain region extending from the Blue Ridge mountains to the Great Smokies which form the western boundary of the state. Elevation ranges from 1,000 to 6,700 feet. The Blue Ridge is the water-shed, and the fauna and flora of the mountain region partakes to some degree of the nature of the Mississippi valley, though the Great Smoky Range cuts off many of the typical and more southern forms. I shall only mention such insects as are of interest as showing distribution, variation in habits, remedies, etc.

The Eastern Region.

This portion lies principally in what is biologically known as the humid area of the Lower Austral Zone, a zone not at all represented in Ontario. The soil is for the most part sandy, or a black muck or peat. The crops are corn, cotton, peanuts, sorghum, a little rice along the coast, potatoes (both Irish and Sweet), and garden truck for early shipment to northern markets.

Insects of Staple Crops. The Black Grain weevil, *Calandra oryzae*, occurs abundantly throughout this region. Carbon bi-sulphide is the remedy recommended, and is satisfactory when properly applied. The Corn Bill beetle, *Sphenophorus sculptilis*, is destructive to young corn on low lands, especially those subject to overflow. They are worse on lands just from rice sod, and the avoidance of such lands is the only satisfactory method of averting injury. During the last two seasons there have been serious outbreaks of the Sugar-cane Beetle, *Ligyrus rugiceps*, although this is typically a pest of the cane plantations along the Gulf of Mexico. A satisfactory remedy for this insect is yet to be devised. Late planting was the only expedient which proved worthy of notice. The Corn Stalk-borer, *Diatraea saccharalis*, (Lepidoptera) is also destructive throughout this area, while the Ear-worm, *Heliothis armigera*, (Lep.) I have seen destroy whole fields of sweet corn, every ear containing from one to twelve of the voracious larvæ. This latter insect is also frequently guilty of boring into the bolls of cotton, and of recent years, since there has been so much discussion of the Boll-weevil, farmers often mistake it for this pest. The peanut has no serious insect pest to my knowledge.

Insects of Garden Crops. Throughout most of this region the Potato-beetle, *Doryphora 10-lineata*, is abundant and destructive, though, curiously enough, I had a report from one isolated locality that it appeared there in numbers for the first time in 1901. It can hardly be said that spraying is a common practice even in combatting this pest, as labor is generally so ignorant throughout this region that pumps would be rapidly broken, and the work would be poorly done. Hand-picking is, therefore, much relied upon

even at this late day. Paris green mixed with lime or land plaster is also widely used as a dust application. It is only within the last year that I heard of three field sprayers, spraing four rows at a time, being purchased in this section, although the growing of Irish potatoes is a leading industry in many localities. Some few of the growers have knapsack pumps, but the universal complaint is that hands are not to be had who will honestly and carefully do a day's work with them.

The Harlequin Cabbage Bug, *Murgantia histrionica,* (Fig. 8), while common enough in all the state east of the mountains, is much more abundant here than further west. It is one of the Stink-bug family (Pentatomidae), and is a destructive enemy of cruciferous crops, especially cabbage and collards in this region. Hand-picking and late planting are the principal remedies.

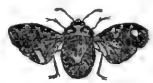

Fig. 8. Harlequin cabbage bug.

In the strawberry section the Strawberry Weevil, *Anthonomus signatus,* is the most important enemy. So far as I have been able to learn this is the southern-most region for this pest on the Atlantic seaboard, but surely it is very destructive here. It lays its egg within the bud and then cuts the pedicel. The staminate varieties are chiefly attacked, and by the use of a large proportion of pistillate varieties the growers are able to secure the greatest degree of immunity. The insect also breeds in abundance on the blackberries (*Rubus sp.*), which grow wild in that region, and the use of fire to burn out these vines as well as to run over the berry fields as soon as picking is over, is coming into favor, as many of the developing larvæ, pupae, and fresh adults are still in the fields after the last of the crop is removed.

Insects of Orchard Fruits. The *Codling Moth* is abundant and destructive in this section, good crops of apples being a thing almost unknown in recent years. Within the last few years, however, spraying is becoming more popular in the orchards, especially as these are generally small and the owners in many cases do their work with their own hands. The *Plum Curculio* throughout this region is as destructive to the peach as to the plum. The jarring method is being widely used in commercial orchards, as it is a purely mechanical process which can be done by even the most ignorant laborers, for even they can soon be taught to recognize the adult beetle. The largest peach and plum section is in the western part of the Eastern Region, at Southern Pines. Here the *San Jose Scale* has been well known for the last ten years, yet I know of many thousands of trees which have been known to be more or less infested for eight years, and which this year brought forth the sixth consecutive profitable crop, a tribute to the efficacy of careful, persistent spraying. In these orchards oils and soaps were relied upon until about three years ago, since which time the Lime-Sulphur-Salt wash has held sway. One large orchard has been treated principally by the fumigation method, and is in excellent condition, and the owners are now undecided whether it will be better to renew their outfit of tents or resort to the wash. I think that the tendency is, and will continue to be, to avoid the use of self-cooked mixtures or chemical substitutes, and use only the wash made of lime, sulphur *and salt*, boiled with artificial heat for not less than one hour. In this particular region white labor is quite obtainable, hence conditions are more favorable for the use of such washes as require care in their preparation and

use. The experience there has been that the best time to apply the wash is as late in winter or early spring as possible, just so the work is completed before the buds actually open, the advantage of this being that the coating adheres through a large part of the summer, and renders it difficult for the young to obtain a foot-hold. One thorough, annual treatment has been found sufficient, two or more being necessary only when trees have been neglected, or the scale not discovered until badly encrusted. By making the treatment late the growers also secure much fungicidal effect, so much so that many will hereafter use a late treatment for the scale, and also for its effect on fungi, thus taking the place of the usual late winter treatment with the Bordeaux Mixture. Indeed, from the present outlook it seems not unlikely that in many apple and pear orchards the scheme of spraying will eventually be as follows:—

1st. Just before buds burst with Lime-sulphur-salt.
2nd. Just after blooms fall with Bordeaux and Paris green.
3rd. Ten days later with Bordeaux and Paris green.

The southern method of jarring for the *Curculio* also deserves notice. Two men are engaged in the work of jarring a tree, each being provided with a semi-circular frame or screen large enough so that the two will include all the space directly beneath the branches. The two men walk rapidly along the rows, one on each side, and, bringing the screens together under each tree, a few quick, hard blows are given with a padded club. After some ten to thirty trees have been jarred in this way the screens are lowered to the ground and the jarring carefully searched for adult Curculios, which are crushed in the fingers. The method is quite rapid, two men having been observed to jar and kill the insects from 24 trees in 6 minutes. In the large commercial orchards this method is almost universal, and they find that the beetles appear first along the edges of the orchard, indicating that they hibernate in woods or fields, but I have never yet taken one of the insects in hibernating quarters. The growers make an effort to have each tree jarred at least twice a week, but still they prefer to give more attention to the outside rows, hence the trees bordering woods may sometimes be treated four or five times in the week while those in the interior may be jarred only once or twice.

Among insects not of economic importance this region is notable for a strong infusion of southern forms. Several times we sent insects to the National Museum at Washington representing species which they reported belong typically to the Florida fauna. The Orange-dog butterfly, *Papilio thoas* which has of recent years been taken even in Southern Ontario, is common in eastern North Carolina near the coast, though many years of careful collecting has failed to reveal it at Raleigh, about 120 miles inland. Here the handsome skipper, *Eudamus proteus*, is also found, and less than a month ago this species was taken at Raleigh for the first time. The swallow-tail *Papilio palamedes* is also abundant through the summer near the coast. Among the Pierids, I think that *Pieris monuste* occurs, though this opinion is based only on a brief glimpse of a specimen taken to be this species on one of the low, sandy islands along the coast. The dragon-flies, *Libellula* and *Calopteryx sp.*, are also found here.

The Middle Region.

This region lies about equally in the lower austral and upper austral zones. The typical soil is a red clay, but this varies to yellowish clay mingled with much sand and gravel in the east. The crops are corn, tobacco in the north, wheat in the middle, and cotton in the southern areas.

As the upper austral zone includes the southern tier of counties in Ontario, many of the insects of this region are well known in this province. The *Chinch Bug* is rarely reported in North Carolina from either the eastern or the western sections, but it is a standard pest in the middle section. Spraying with kerosene emulsion at a strength of 10 to 15 per cent. oil has been practised in a few instances but only with more or less injury to the crops, and our recommendation was to rely principally upon the well-known plowing methods, and our farmers were surprised to see how effectual even a single, deep, furrow was.

The Hessian Fly is another pest which is practically confined to this region, probably mainly because very little wheat is grown in the other sections. At any rate it is here a very destructive insect in the best wheat section of the state. Late planting is the preventative usually employed, and careful inquiry brought out the fact that from October 15th to November 1st is the safest time to sow to avoid fly and at the same time escape the injurious effects of winter freezing. Wheat is frequently sown as late as the last week in November, and I have been told of seeding in Xmas. week.

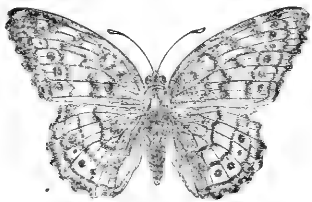
Fig. 9. Euptoieta claudia.

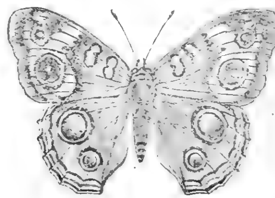
Fig. 10. Junonia cænia.

There are but few insects which I could name as distinctive of this region. One of the most characteristic butterflies is *Euptoieta claudia* (Fig. 9), the larvæ of which are everywhere common on the May-pop or Passion-flower. Another is the Buckeye, *Junonia coenia* (Fig. 10). Both of these butterflies are almost too southern in range to be expected in Ontario, though I suspect, without having inquired, that they are occasional in the southern counties.

[They have been taken, though rarely, in the Counties bordering on Lake Erie.—Ed.]

The Western Region.

This region is characterized by high plateaus and mountain ranges. It lies in the Transition and the Boreal life-zones. The Transition includes all of Old Ontario between the northern and southern tiers of counties, and the Boreal includes practically all of New Ontario and the great region about James Bay. Of course the more northern animals and plants of these regions are not represented in North Carolina, but one would be surprised at the similarity of the mountain plateau region and the country right here at Guelph. Cattle-grazing is one of the chief agricultural occupations, while hay, potatoes, oats, and apples are also standard crops. This is the only region where currants, raspberries, and rhubarb can really be said to be a success. Here, too, one finds many of the typical Ontario insects and insect pests. The currant bushes are regularly attacked by the currant worm, and the apple trees by the Oyster-shell scale, which is only known to me in this state in the mountain and west-central parts of the state. In

the steep mountain orchards the dust-spray is being experimented with. As one apple-grower in this region has something over 30,000 trees now coming into bearing, the cheapest, efficient means of spraying the trees becomes an important question. *The Scurfy Scale* is more abundant here than elsewhere in the state.

Among the insects not of economic importance a specialist in lepidoptera could, doubtless, name many species well known to our most active collectors. Among the butterflies may be mentioned such forms as *Argynnis aphrodite, A. diana, A. cybele, Brenthis myrina, Grapta faunus, G. comma,* and *G. j-album.* I had threatened to capture *Basilarchia arthemis,* and *Vanessa milberti,* and even cherished a fond hope of finding a stranded colony of *Chionobas* on one of the high mountains, but further exploitation of this interesting region must now be left to others. But it is extremely interesting, as showing how mixed are the faunas in these southern mountains, to point out that in the extreme southwest corner of the state *Papilio thoas* (Fig. 11), and the Gulf Fritillary, *Agraulis vanillæ,* both appear to be somewhat common.

General Observations.

A more interesting territory for the entomologist can scarcely be found than North Carolina. Most of the collectors of insects are in the north, and when these collectors have gone south at all they have gone through to Florida, Georgia, Louisiana or Texas. Consequently there is a great strip of middle ground which has never been at all adequately explored. Even in economic entomology nothing definite has been attempted previous to the opening of this new century. The entomologist in this state is, therefore, met by persons of every conceivable attitude toward his work, some incredulous, some interested, some contemptuous, and some indifferent. The farming classes, as a whole, however, have in recent years been brought to see the importance of this work. The wide spread of the San Jose Scale, the threatening danger of the cotton Boll-weevil, and the almost total destruction of fruit crops by the Codling Moth and Curculio in the eastern section, have brought them to a realization of its true meaning.

For the five years that the writer was located in North Carolina, he, his assistants, and a Mr. Brimley, at Raleigh, were the only active collectors known to be residing in the state. Within the last few months another collector, a native of Connecticut, was discovered. Now there are two or three school teachers who are doing a little work along this line, though in a very primitive way. Altogether, the state is, as yet, practically unexplored, entomologically.

While spraying is gradually coming into vogue, the pumps are, as a rule, cheaper and more inefficient than those in use in the north. In order to get the practice started at all it has been necessary to begin at first in the simplest manner possible. But the poverty of the farming classes in past years, and the unreliability of the labor, would in any case have rendered the more expensive machines impossible. In the largest peach and plum section, where the San Jose Scale is generally distributed, barrel pumps with two leads of hose, each with a single nozzle, are principally used. Large tanks and heavy machinery could not be used here on account of the very sandy nature of the soil, through which the wheels readily sink so that heavy loads are impossible.

The generally prosperous years of recent times, and the development of enormous fruit and trucking industries throughout the south to supply the large and expanding northern markets, is giving cause for more demand for

information, about insect pests and methods of combatting them, and at the present time more places are open for the employment of economic entomologists in the south than any other section, so far as the writer is aware, while it goes without saying that in regard to life histories, broods, hibernation, etc., much more remains to be discovered there than in the more northern states.

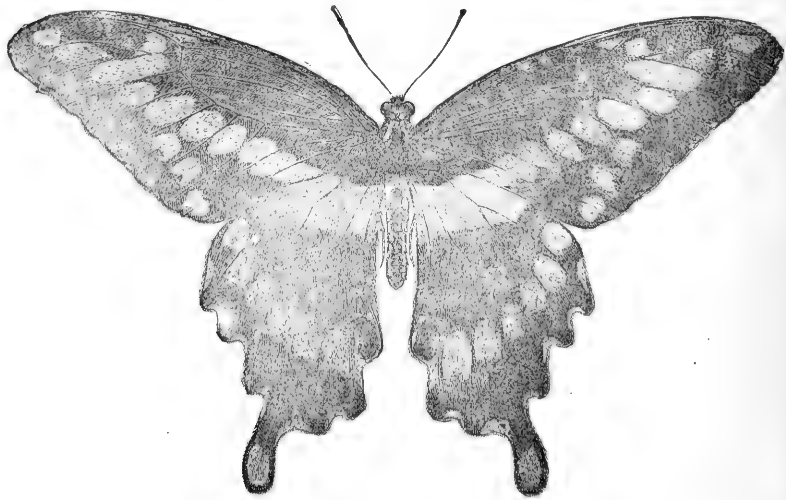

Fig. 11. Papilio thoas, the Giant Swallow-tail Butterfly. Colours black and yellow.

In the discussion that followed the reading of this paper, the first insect that was commented upon was PLUM CURCULIO (*Conotrachelus nenuphar*).

Dr. Fletcher spoke in high terms of appreciation of Prof. Sherman's paper, and congratulated the Society upon the addition to its members of so able and enthusiastic an entomologist. He remarked that the Plum Curculio in Canada was kept in check almost entirely by spraying, and that jarring was rarely resorted to.

Mr. GEORGE E. FISHER had tried both methods, but preferred spraying, as it proved more effective, and had the additional advantage that a fungicide could be used with the Paris green, and thus a double result was accomplished. Mr. Willard, of Geneva, N.Y., whom he had visited, depended entirely upon jarring for the protection of his plum trees. He uses the wheelbarrow system, and employs twelve men, each with a barrow, for the purpose. As the Curculios are very susceptible to cold, the jarring is done in the early morning when they are sluggish and have a less firm grasp on their resting place. As many as a hundred of the beetles were often shaken from one tree. There was undoubtedly one advantage in jarring,—you killed the beetle for certain, whereas in spraying you only distributed poison for the insect to eat and could not be sure that he would partake of it.

Dr. FLETCHER said that the cost of the labour required for jarring was very much greater than for spraying. Good paying results were obtained by the use of the latter method, and, as Mr. Fisher had stated, there was the

great additional benefit derived from the addition of Bordeaux mixture to the Paris green or arsenate of lead. For his part, he much preferred to use, and always recommended to others, Paris green rather than the arsenate, as its conspicuous color prevented any danger of its being mistaken for anything else.

San Jose Scale.

Mr. G. E. Fisher, in the discussion on Prof. Sherman's paper, referred to the methods of dealing with the San Jose Scale, and first to the use of the lime, salt and sulphur mixture. He preferred to dispense with the salt as it corrodes the pumps, and in his experience the mixture destroyed the scale better without it. He used a heavy wash of the mixture, employing one pound of lime to half a pound of sulphur in each gallon of wash. It should be cooked *for two hours*, not for one only, as was the common practice. He made use of the steam from a threshing engine for the purpose, and cooked twelve barrels at a time, in order to have an abundant supply both for himself and his neighbours. The test of the boiling was that the mixture should finally turn green.

The results were most satisfactory. An orchard of one hundred trees of all sorts, badly infested with the scale, was treated three or four years ago with the wash made in the manner just mentioned and was sprayed thoroughly; no scales have been found there since. The wash should be applied by the middle of April, not later; he had found it safer to do the work from the middle of March to the middle of April, if later injury was done to the opening buds.

Prof. Sherman expressed the opinion that it was best to apply the wash as late as was safe, as he found that it stuck to the trees better and did good work for a longer time. His mixture consisted of 20 lbs. of lime, 17 lbs. of sulphur and 10 lbs. of salt to each 50 gallons. In an orchard containing 20,000 peach trees the wash had been tried both with and without the salt, and the results when the salt was included were much better than without it. The boiling was done for at least one hour and the spray was applied while hot. The advantage from the salt was that it made the wash stick better.

Prof. Lochhead read the following paper in which he gave an account of his recent experiments in treatment for the scale.

EXPERIMENTS AGAINST THE SAN JOSE SCALE IN 1905.

By Wm. Lochhead, Professor of Botany, Ontario Agricultural College, Guelph.

During the eight years that the San Jose Scale has been in Ontario many remedies have been devised and applied for its extermination. Among the early remedies were whale oil soap, kerosene and kerosene emulsion, potash solution, soda solution, and dilute crude petroleum. All of these were only partially successful. The whale oil soap was a most effective destroyer of scale and a tonic for the tree, but was too expensive for the ordinary fruit-grower to use. The potash and soda solutions were not sufficiently effective against the scale to make them favorite remedies. Kerosene, either pure or dilute, was too unsafe, and was soon discarded. The kerosene emulsion, although quite effective in controlling the moving larvæ, was not at all

adapted as a remedy for the scale under other conditions, and hence was abandoned. During the last few years new remedies have appeared and have been remarkably successful. Probably the most effective of these is the lime-sulphur wash. Various combinations of this wash have been tried, in order to determine the most satisfactory remedy for the scale, from the standpoint of both effectiveness and cheapness.

The following are the formulæ which have been usually adopted in Ontario for the preparation of these different combinations of the lime-sulphur wash:

The Lime-Sulphur Wash (fire or steam boiled):

Fresh lime	20 pounds.
Sulphur (flowers)	15 pounds.
Water	40 gallons.

With warm water make the sulphur into a paste; put in the lime and add about 15 gallons of warm water with stirring. The sulphur made into a paste may be added after the lime has been slaked. Boil for an hour and a half in a kettle or in a barrel with live steam. Make up to 40 gallons with hot water; strain into spray tank and apply while warm.

Some of our fruit-growers obtained excellent results by using larger proportions of lime and sulphur to the barrel, namely, 35 of lime and 20 sul-sulphur; 25 lime and 20 of sulphur. The time given to the cooking of the lime-sulphur wash is quite different in different localities, and even by fruit-growers in the same localities. In some cases the wash is boiled for an hour and a half to two hours, in other cases it is boiled for one hour, and many state that they have obtained good results by boiling for only one-half hour.

Lime-sulphur Wash (self-cooked):

Formula No. 1 Recommended by Mr. A. N. Brown, Wyoming, Delaware.

35 pounds of best stone lime.
17 pounds flowers of sulphur.
40 gallons water.

(1) Put the 17 pounds of sulphur into a vessel, add two gallons boiling water, a little at a time, stirring vigorously all the while until a fine paste is obtained.

(2) Put the 35 pounds of lime in another vessel, large enough to hold 40 gallons, pour into this lime 12 gallons boiling water; now add the sulphur paste previously prepared. Very quickly cover the barrel with a heavy burlap sack, having placed an old hoe into it first; now allow it to cook for 30 minutes. Do not stir, as that reduces the heat by letting in cold air, but with the hoe raise it from the bottom occasionally so that it does not run together and burn before the lime is thoroughly slaked. Nothing must be done to interrupt the cooking process, as that would affect the final quality of the wash.

(3) After this mixture has cooked 30 minutes, add 28 gallons of warm water, not necessarily boiling. Strain into the spray tank, and apply while warm, as in this condition it will flow through the spray pump nozzles more easily than when the wash gets cold. It will also remain in solution much more thoroughly when it is warm than when it cools.

Formula No. 2.

25 pounds good stone lime.
20 pounds flowers of sulphur.
12½ pounds sal soda.
40 gallons water.

Put 5 or 6 gallons of hot water in a wooden barrel, add the lime, quickly following with the sulphur and sal soda, and stir until the slaking is practically completed. It may be necessary to add a little cold water at intervals to keep the mixture from boiling over. After the violent action has ceased, cover the barrel to retain the heat and allow it to stand 15 to 30 minutes, dilute to the full quantity and apply.

Formula No. 3. (Geneva formula).

30 pounds of good stone lime.
15 pounds of flowers of sulphur.
4-6 pounds of caustic soda.
40 gallons of water.

In preparing the wash, the lime was started to slake with six gallons of water, and while slaking, the sulphur, which had just previously been made into a thin paste with hot water, was added and thoroughly mixed in with the slaking lime. To prolong the boiling of the wash, the caustic soda was then added with water as needed, and the whole mixture was kept thoroughly stirred. As soon as the chemical action had ceased the required amount of water was added, when the mixture was ready to use. Aside from the heating of the water, the cooking of the wash was done in a tub or barrel, and took from ten to twelve minutes. In some preparations, especially when hot water was used to start the slaking of the lime, not all of the stated amount of caustic soda was employed, but six pounds was the minimum.

Dr. Felt, New York State Entomologist, writing under date of Oct. 30th this year, advocates the employment of a lime-sulphur wash composed of 20 pounds of lime, 15 pounds of sulphur, and 40 gallons of water, bringing about the combination either by using 10 or 12 pounds of sal soda and starting the action by hot water in a barrel, or by boiling for at least 30 minutes.

It will be noted that salt has not been used in the preparation of any of these mixtures. In the preliminary experiments carried out three years ago by Mr. G. E. Fisher, he came to the conclusion that the presence of the salt added to the expense, made the wash more difficult to spray, and increased its corrosive action on the metal parts of the pump; while it failed to be any more effective as a destroyer of scale, or more adhesive to the bark of the tree. Whether these conclusions will be borne out by future experiments remains to be seen, but some observations made this year show that probably the presence of the salt is beneficial, and it would be advisable to conduct experiments this coming season to test this very point.

My observations this season would, I think, incline me to believe that the presence of salt renders the wash more adhesive, and hence more effective. I found, as a rule, that in those orchards where the mixture adhered longest and best to the bark the scale had made but little progress.

It would appear that the *adhesiveness* of the wash is a large factor in its *effectiveness*. The tremendous reproduction of the scale that occurs in September and October can hardly be checked, or the spread prevented, unless the bark has a coating which is either distasteful or harmful to the crawling larvæ. For this very reason that the bark is made clean and enticing to the larvæ during the last months of the growing season, other remedies fail to keep the scale in check, when only one application was made and that application in the spring just before the buds opened.

As to the results of the season's experiments with lime-sulphur, it may be stated in a general way that little or no difference could be observed between the effectiveness of the cooked and uncooked washes. Some orchards that had been treated with the cooked wash showed more scale at the end of the season than at the beginning, and the same results were observed in

some orchards treated with the uncooked wash. On the other hand, it should be stated that both washes gave good results in many orchards. The reason for this variation in results is difficult to find; for example, Mr. W. H. Bunting of St. Catharines, who did not check the development of the scale with the cooked wash, is a most careful and thorough sprayer. On examination of Mr. Bunting's plum, peach, pear, and apple orchard in late October, Mr. P. W. Hodgetts and myself found the scale more abundant and more wide spread than at the close of any previous season. Like results were observed in Mr. Bunting's orchard at his home in St. Catharines. The scale had spread and partly encrusted many trees in spite of treatment with the cooked wash in the spring.

Mr. Titterington's orchard composed of peach and plum chiefly, just across the Welland Canal, was sprayed also in the spring with the cooked lime-sulphur wash. The trees near the road at the south end were fairly free from scale, but many trees at the north end were quite badly infested.

Mr. Irvine, near Queenston, on the Queenston Road, used the cooked lime-sulphur wash prepared according to the usual formula. The results might be said to be good in spite of the fact that there is now a sprinkling of scale in his peach orchard. Many of his Japan plums and a few of his peach trees, however, are badly infested. Mr. Muir, of Virgil, also sprayed with the cooked wash and speaks very highly of its merits. Certainly the condition of his trees at the end of October would seem to justify his opinion, for there was but a slight scattering of scale. This is saying a good deal when we remember that the scale is very bad throughout the Virgil district. In Mr. Muir's orchard the wash on the bark was quite visible in most of the trees up to the end of the season.

Mr. Lambert's orchard near the Welland Canal was sprayed thoroughly in early spring with the cooked lime-sulphur-salt wash. Two rows of Japan plums, badly encrusted last season, were in good condition, and the scale was not abundant. These trees showed very plainly the wash at the end of the season, and were perhaps the best in this regard of all the trees we examined. To my mind the presence of the salt made the wash more adhesive than that applied by his neighbors; moreover, it is very likely due to the extra adhesiveness of this wash that the scale was so reduced in numbers.

In the peach orchards of Mr. Porter Adams, on the Queenston road, near Queenston, the uncooked lime-sulphur wash was used. The results were good, although there was a slight sprinkling of scale throughout his orchard. Untreated trees were very bad, the bark being wholly encrusted. An interesting observation in this orchard is worth recording. There were three, and only three so far as we could find, badly injured peach trees in the sprayed orchard, and these were not close to one another. These received the same application as the other trees, but they are now encrusted with scale.

Mr. Bradley, near Mr. Adams, was not so successful with the uncooked wash. We are told, however, that the trees received a one-sided application on account of the high winds that prevailed at the time of spraying. The older trees of this orchard are now badly infested.

Mr. C. A. Secord used the uncooked lime-sulphur wash in his fine 16-acre peach orchard, and secured excellent results. Scale was there, but it was rather hard to find. The owner is perfectly satisfied with the results, and will use a similar wash next spring.

Mr. Beattie, Scale Inspector, of St. Catharines, tried Scalecide, Carlson's Mixture, and the uncooked lime-sulphur wash in his own orchard.

After examination of the trees we concluded that the last wash gave the best results, although scale was plentiful on all his trees in October, at the time of our visit.

As part of the experimental work for 1905, in addition to the lime-sulphur washes, Mr. P. W. Hodgetts and myself tried some new mixtures which had been advocated, viz., *Carlson's Mixture*, and *Pratt's Scalecide*.

In the peach orchard of the Industrial Home near St. Catharines, Carlson's Mixture, kerosene-flour, and uncooked lime-sulphur were used. The first two did not give satisfactory results, for scales were very abundant on trees treated by these mixtures; the last, viz., the uncooked lime-sulphur, in our opinion, did its work well, for scales were very scarce on trees treated by it. Here again, the wash was quite evident on the bark to the end of the season. The condition of these trees is remarkable when we bear in mind that across the fence is an untreated peach orchard which is terribly encrusted and rapidly dying. The few trees left untreated as checks are now very badly encrusted.

As I have already stated neither Scalecide nor Carlson's Mixture gave as good results in Mr. Beattie's orchard as the uncooked lime-sulphur. It appeared to us that in this orchard Carlson gave better results than Scalecide.

Carlson's Mixture and the kerosene-flour emulsion were also tried in a peach orchard belonging to Jas. Hutchison, near Virgil, the bulk of the orchard, however, remaining untreated. Results were far from satisfactory with both mixtures, the treated trees showing serious incrustation, although not quite as bad as those left untreated. This orchard furnishes an instance of the awful multiplication of scale in a single season. When the trees were sprayed on April 19th, a record was made in our note books to the effect that the orchard was comparatively free from scale, yet on October 24th, when we examined the orchard, the trees were very badly encrusted.

Scalecide and Carlson's Mixture were applied to some Japan plum trees belonging to Mr. Porter Adams, Queenston. Results were not satisfactory, as the trees are now badly infested.

A few Bartlett pear trees in Mr. Hodgett's garden, St. Catharines, were sprayed with the summer strength of Scalecide, but the results showed it powerless to control the scale.

Mr. Henry Kottmeier used Carlson's mixture on his plum orchard, but the results here too were far from satisfactory, and the majority of the trees are now badly infested.

In a small orchard near Mr. Kottmeier's, Carlson's Summer Mixture was applied, but it was not able to any extent to prevent the scale from multiplying. The treated trees are now badly infested.

Other examples of treated orchards might be stated, but enough has been given to show the values of the different mixtures as scale destroyers. None of the new mixtures, such as Carlson's, Pratt's Scalecide, or the kerosene-flour emulsion, can be recommended to the fruit-growers as effective remedies for the San Jose Scale. The lime-sulphur washes gave better results in every case that came under our observation.

We are not in a position to decide definitely whether the uncooked lime-sulphur wash or the cooked wash is the better remedy. To us it would appear that the personality of the man who makes and applies the wash counts in most cases for success or failure. Careful preparation of the wash according to formula, the use of good rapid-slaking stone lime, and thorough application to the trees will in nine cases out of ten check the scale completely. Moreover, we are of the opinion that the addition of salt to the wash would increase its adhesive qualities, and add to its effectiveness.

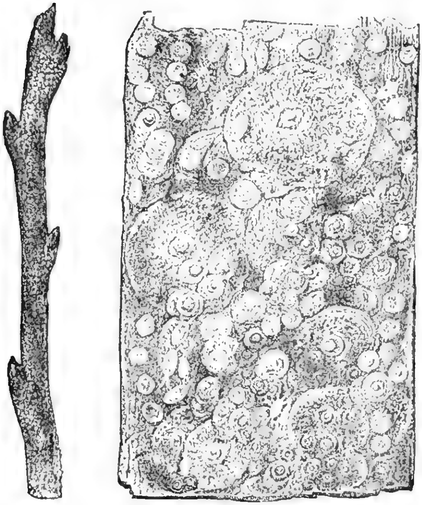

Fig. 12. San Jose scale: an infested twig, scales and larvæ on bark—much enlarged. (After Howard and Marlatt.)

Prof. J. B. Smith, upon being called upon by the Chairman, said that it was evident that the experience in dealing with the scale was in no two places the same. In New Jersey it was found that the effect of spraying with lime and sulphur was slow and cumulative; if properly done, no young were produced, and the results were very satisfactory. In Georgia, in a large orchard, containing over half a million trees, the lime and sulphur wash was used without any salt and with a larger proportion of lime than usual; the mixture, it was found, did not adhere so well to the trees. The next time salt was added to the mixture, but not much difference was to be seen in the results. The addition of salt made it spray more easily and spread better. In Georgia and elsewhere many fruit-growers think that the application of the lime and sulphur wash spoils the trees, and therefore they prefer to use the oil treatment, either crude petroleum or kerosene. Pratt's Scalecide, a preparation of soluble petroleum, was found satisfactory.

With lime and sulphur he found that the thinner the wash the better it penetrated: he recommended boiling the mixture because by so doing good results can be secured even with bad workmanship and inferior materials, and using equal parts of lime and sulphur. This mixture was effective on peach and plum trees, but was no good on apple and pear trees. An apple orchard was treated with this wash, and in June the trees were still coated, but they did not bear an apple worth marketing on account of the scales that covered them.

For apple and pear trees he recommended the oil treatment, using one part of petroleum with twenty of water. Spraying should be done as early as possible in the fall because many of the scales were still active and they were not so closely adherent to the trees as later on in the winter; the oil could therefore get at them better and destroy the insects. This method was very effective in keeping the scale in check, and we could not hope for extermination.

Dr. Fletcher, the chairman, in closing the discussion, said that it was evident that good results can be obtained in the contest with the San Jose Scale by using the crude petroleum treatment on apple trees and the lime and sulphur wash on peach and plum.

EVENING SESSION.

Wednesday, October 18th, 1905.

A public meeting was held in the Massey Hall at the Ontario Agricultural College, at 8 o'clock p.m., and was largely attended by members of the Society, students of the College and Macdonald Institute, and visitors from the city of Guelph. The chair was taken by Dr. Fletcher, the Vice-President.

President Creelman welcomed the Society to the Ontario Agricultural College and gave an outline of the different departments of work in it and the affiliated Macdonald Institute. They might be regarded as forming three main divisions: the College for training farmers' sons in all that relates to agriculture; the Farm for growing farm products and carrying on experiments in the cultivation of all manner of field crops, fruits and vegetables, the raising of stock, etc.; the Macdonald Institute, with its two-fold objects of training teachers from rural schools in nature study and elementary agriculture, for which purpose 45 or 50 came three times a year, and of teaching farmers' daughters the best methods of performing household work, such as cooking, sewing, laundry-work, dressmaking, millinery, etc.

Two of their departments of work could hardly fail to strike the average man, these were Agronomy or Field Agriculture, and Animal Husbandry; in the former, seeds of all kinds from all parts of the world are tried and their suitability for this Province tested. Experiments have been going on for some twenty years, some plants are found to be no good and are cast aside, others are useful forms or improvements on those in ordinary cultivation and are duly propagated and made known as widely as possible. About 2,000 plots are employed for this purpose and careful records are kept of each. The value of Animal Husbandry may be gathered from the fact that about eighty per cent. of the produce of farms is fed to live stock; it is therefore most important that farmers should know what is the best breed for his purposes and how the animals should be most advantageously fed and treated. In the spring two hundred farmers are brought here and shewn stock from both the farm and the neighbourhood, in order that they may learn all about them.

Other departments that may be briefly referred to are those of Chemistry for the analysis of soils, food products, fertilizers, etc.; Physics; Bacteriology; Horticulture for testing all sorts of fruits and vegetables; Dairying, a most important department, as it is worth millions of dollars to Ontario that the best butter and cheese should be made and exported; Poultry raising, for teaching the best methods and so reaping the largest profits.

The College is now visited in the month of June each year by farmers and their families to the number of 25,000 to 30,000, who are brought here from all over the Province by special excursion trains. Few of them probably return to their homes without having learnt something that they can turn to practical advantage in their own work. The College, too, is filled with young men who are taking long or short courses of study, and who go back to the farms with a training that will make them more progressive and successful workers, and who will influence for good all those in their own neighbourhood.

Dr. Fletcher, in reply, spoke of the high position the College had attained in public estimation and the great value of its work in improving in all departments the agriculture of the country. While its object was largely to teach how to increase and improve the products of the farm, the work of the Entomological Society was devoted to the saving of a proportion of the crops that would otherwise be destroyed by insects and be a serious loss to the farmer.

Mr. B. Barlow, the President of the Wellington Field Naturalists Club, welcomed the Society to Guelph and extended the cordial greetings of the Club. In the course of his remarks he mentioned that the Club had now been organized for five years, and during that time had devoted itself to the study of the fauna and flora of the County of Wellington, the aim being to make in time a complete biological survey of the district. So far, they had formed a list of over 200 birds observed in the county, with a record of dates, breeding, numbers, etc., and were not likely to add many more to it. In botany, flowers, plants, grasses, ferns, sedges, etc., were being collected and studied; fishes and other aquatic animals, mammals such as squirrels, moles, mice, etc., were also under observation. Fortnightly meetings were held either in the town or at the College and were well attended. He spoke with much gratification of the formation of the new Guelph branch of the Entomological Society, which had been completed this morning, and with which the Club would work hand in hand.

Dr. Fletcher acknowledged the kind greetings of the Club and stated that it was now widely known and had established an excellent reputation for careful work and accurate records. He then introduced the lecturer of the evening, Dr. John B. Smith, Professor of Entomology at Rutgers' College, New Jersey, and head of the Entomological Department of the New Jersey Agricultural College Experiment Station, a notable entomologist of world-wide reputation, one who was distinguished for his scientific work on nocturnal lepidoptera, his practical work in economic entomology and his important researches regarding mosquitoes and public work for their extermination in some badly infested regions on the coast of New Jersey.

The following is a brief abstract of Prof. Smith's lecture, which was illustrated with a large number of lantern slides made from original photographs and drawings.

A REVIEW OF THE MOSQUITO WORK IN NEW JERSEY.*

By John B. Smith.

Mosquitoes are essentially aquatic in the larval stage and none have yet been found that form an exception to this rule. As the larvæ of nearly all the troublesome species are known, and all breed in water, it is safe to plan for practical work on the assumption that the habit is universal.

Of the adult mosquitoes only the females bite, the lancet-like structures being undeveloped in the male which, necessarily, subsists on plant juices only. When a mosquito bites, it injects into the wound a minute drop of poison (saliva) and this seems to break up the blood structure so that it no longer forms a clot: a smear from the mosquito stomach spreads out thin and dries to a brittle scale.

That mosquitoes are active agents in the transmission of certain febrile diseases is no longer seriously questioned and, in general, it is agreed that

*Abstract of a lecture delivered at the evening meeting, Oct. 18th and illustrated with lantern slides.

they are also the only agents; the life cycle of the malarial Plasmodia being now fully understood. In a patient suffering from malaria the single celled protozoöns are present in the red blood corpuscles, each of which furnishes nutriment for one *Plasmodium* which matures and reaches the reproductive or sporulating stage in 24, 48 or 72 hours, according to its kind. When ripe, the cell bursts and the pores are discharged into the blood serum. As all the organisms mature at practically one time, this general sporulation upsets body conditions and a "chill" results. The spores work their way into new corpuscles and the cycle is repeated. After a time bodies are produced that make no attempt to enter new corpuscles; but remain in the blood serum. These are the "gametes" or sexed forms of the animal and they undergo no further development in man. If an *Anopheles maculipennis* now bites the patient, it will take in with the blood some of these gametes which, as soon as they get into the mosquito stomach differentiate. The smaller forms or micro-gametes produce "flagellæ," which break off and conjugate with the larger or macro-gametes, the product of the union forming a "vermicule," which works into the tissue of the mosquito stomach. This developes into a "zygote" and, in about a week that becomes mature, bursts and liberates into the body cavity, thousands of "blasts" which, sooner or later find their way into the salivary glands. Now, when such a diseased mosquito bites a healthy subject, some of the "blasts" are introduced into the wound with the saliva and, if the subject is susceptible, a case of malaria is established; the "blasts" working their way into the red blood corpuscles and starting the vegetative cycle.

The species of Anopheles select quiet pools of water bodies as breeding places and, floating on the surface can maintain themselves in shallows out of reach of most fish. The adults do not fly far and local work is likely to be be effective.

Some mosquitoes migrate or fly for long distances from their breeding places and among those are the species that breed in the salt marshes which occur so generally along the New Jersey coast. These breed as readily in salt as they do in fresh water and their influence extends inland 40 miles at least. In New Jersey this species is dealt with by ditching work, which gets rid of surface water before the larvæ have a chance to develop. The eggs of these migratory species are laid in the marsh mud and in that stage they pass the winter. The high tides of spring furnish water for their development and the broods begin early in May. The specimens that fly far inland are all females, and all of the migrants are infertile.

Filling as well as ditching is practised in some places, and much of the Brooklyn rubbish is gathered in huge tanks, transported on trolley flat cars and dumped on the marshes of Gravesend Bay near Coney Island, N.Y., to the material advance of comfort in that resort.

The common house mosquito, *Culex pipiens,* breeds anywhere and in liquids of all kinds from decently clean water to sewage and even liquid manure. It forms an egg boat and is the only species that agrees in all respects with the early published accounts of mosquitoes. It is not a carrier of any disease known in our climate and it is more as a first class nuisance than as a danger to health that it challenges attention. Local work is very effective against this species, and, indeed, only local work is likely to be of any benefit, since the species is not a traveller.

There is no sort of place where water occurs where mosquitoes will not breed, and even tree holes have their own fauna. In New Jersey one species of *Anopheles* and two species of *Culex* occur nowhere else.

The most marked recognition of the mosquito danger ever displayed was in the fight carried on against the recent epidemic of yellow fever at New Orleans, La. The surgeons in charge accepted the theory of transmission by *Stegomyia* only and bent all their efforts *first*, to the destruction of the *Stegomyia*, and *second*, to protecting patients and others from mosquito bites. As to the habits, etc., of this species I must speak at second hand, since it does not occur in New Jersey.

MOSQUITOES.

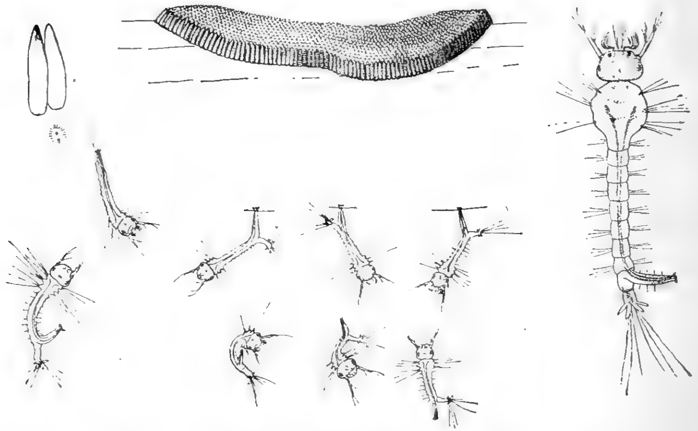

Fig. 13. Mosquito (Culex pungens) egg-mass above, with much enlarged eggs at left; larvæ on right and below. (After Howard, U. S. Dept. of Agriculture.)

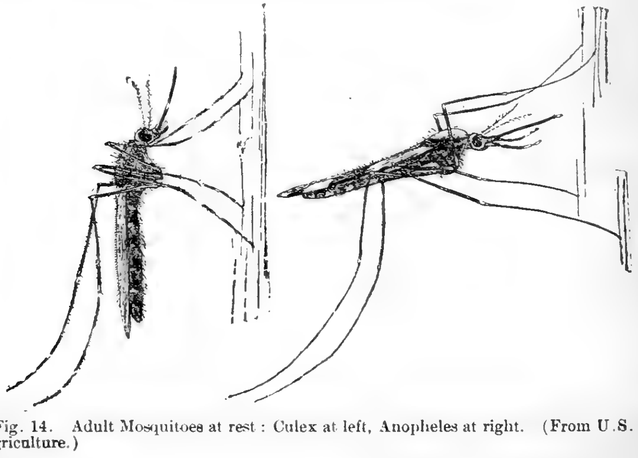

Fig. 14. Adult Mosquitoes at rest: Culex at left, Anopheles at right. (From U.S. Dept. of Agriculture.)

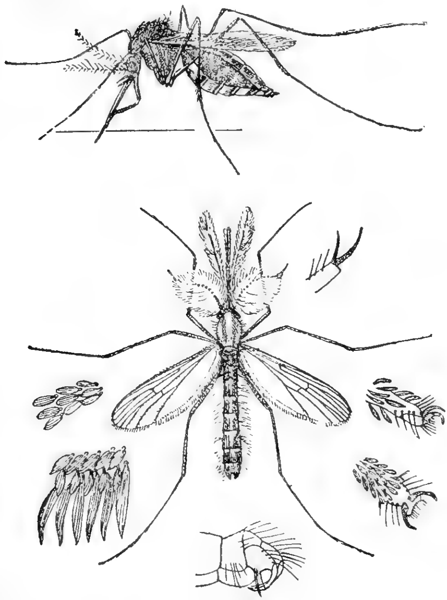

Fig. 15. Mosquitoes (Culex pungens): female above, male below—different forms of scales. All greatly enlarged (after Howard, U. S. Dept. of Agriculture.)

At the close of the lecture which was listened to with marked attention and interest by the large audience, a hearty vote of thanks to Prof. Smith was proposed by Mr. C. C. James, Deputy Minister of Agriculture for Ontario, seconded by the Rev. Dr. Fyles, of Quebec, and enthusiastically adopted by the meeting.

SECOND DAY'S SESSION.

Thursday, October 19th, 1905.

The Vice-President, Dr. Fletcher, took the chair at 10 o'clock a. m. There were forty-six persons present and this number was increased during the morning.

Mr. T. D. Jarvis, Lecturer in Entomology at the Agricultural College, read papers, illustrated by specimens, on insects collected in Jamaica; two species of Saw-flies (Lyda) taken at the College Farm; notes on the genus Phytoptus; three species of bumble bees that fertilize red clover at Guelph; notes on two species of Fenusa; and Parasites of the Abittibi country.

Papers were also read, and will be found in subsequent pages of this report, by Dr. Fyles on forest insects; Mr. A. Gibson on insects of flowering plants; Mr. Lyman on the Formation of an Entomologist's Union;* Mr. Zavitz on some forest insects; also a paper sent by Mr. J. Stevenson of Montreal on insects of the season.

During the sessions a large number of rare and interesting specimens were on exhibition and attracted much attention. Mention may be made of the following:

By Professor Sherman: some small collections of recent captures of local insects, to show his system of labelling; among them was a remarkable form of *Pyrameis cardui*, the Painted-lady butterfly.

By Mr. Zavitz: a large number of wood-boring insects (Cerambycidæ) collected at Ridgeway, Ont.

By Mr. T. D. Jarvis: a number of Jamaican insects, sawflies and other insects, referred to in his papers, taken at Guelph.

By Mr. Lyman: a case of lepidoptera in which were interesting specimens of Gortyna and other noctuids, and also some rare diurnal Lepidoptera.

By Dr. Fyles: a number of forest insects in illustration of his paper.

By Mr. Young: a magnificent case containing over a thousand specimens of Micro-lepidoptera all most beautifully spread and mounted; also a number of Noctuids—these were all collected at Ottawa during the season of 1905. He also exhibited some living specimens of the grotesque pupæ of *Feniseca Tarquinius*.

By Dr. Fletcher: a collection of Lepidoptera made in the Yukon Territory by Mr. J. Keele of the Dominion Geological Survey Department; this included *Colias Boothii* and *Pelidne*, *Erebia Magdalena* and *Disa*.

By Mr. A. Gibson: a case of rare lepidoptera, inflated larvæ, and living larvæ of *Apantesis vittata* received from Mr. E. Denny of Montreal.

By Mr. C. W. Nash: specimens of a remarkable fungus growth (Cordyceps) on wire-worms.

Many of these exhibits will be found recorded, with dates and other particulars, in the "Entomological Record for 1905."

*Published in the Canadian Entomologist.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its report for the year 1904-5.

The forty-first annual meeting of the Society was held in London on the 26th and 27th of October, 1904, and was well attended by local members as well as by many from a distance. There were also present Prof. H. F. Wickham, of the University of Iowa, Iowa City, an eminent coleopterist and an honorary member of the Society, and Mr. T. N. Willing, Chief Inspector of Weeds and Naturalist for the Department of Agriculture, Regina, N. W. T. During the first afternoon reports were read from the various Branches, Sections and Officers of the Society, and from the Directors on the notable insects of the year in their respective districts. Mr. Willing gave an interesting account of the methods adopted in the North-West Territories for controlling noxious weeds and dealing with injurious insects.

In the evening a public meeting was held at the Normal School at which the President, Professor Lochhead, read his annual address and Prof. Wickham gave an able and interesting paper, illustrated by a large number of lantern slides made from his own photographs, on "The Great Basin in the Western States and its Entomological Features." The second day was taken up with the election of officers and the reading of papers on a variety of entomological subjects. A large number of interesting specimens were also exhibited by the members present.

The 35th Annual Report on economic and general entomology was sent to the Department of Agriculture in January last and in due course was presented to the Legislature of Ontario and ordered to be printed. Owing to changes in the methods adopted by the King's printers and other causes for which we are unable to account, the volume has only just been published. The great delay impairs to some extent the value of the report, and has produced wide-spread complaints from members and correspondents in all directions.

In addition to the papers already referred to, the volume contains the following among other articles: "Insects injurious to Ontario crops in 1904" and the valuable "Entomological Record for 1904," by Dr. James Fletcher; "Notes on the Basswood, or Linden insects" and on "The Columbine Borer" by Mr. A. Gibson; "Insect Names and Insects Lists," by Mr. J. B. Williams; "Insects collected at light during 1904," by Mr. J. D. Evans; "Insects affecting the oak," and "the Food habits of certain Hymenoptera," by Rev. Dr. Fyles; "Notes on the Season of 1904 in Western Quebec," by Mr. C. Stevenson; "An elementary study of insects," by Prof. Lochhead; an obituary notice, with portrait of the late J. Alston Moffat.

The Canadian Entomologist, the monthly magazine of the Society, has been regularly issued. The 36th annual volume was completed in December last and ten numbers of volume 37 have now been published. The volume for 1904 consisted of 367 pages and was illustrated with four full-page plates, one of which was coloured, and a number of figures from original drawings. The contributors numbered 63 and included writers in Canada, the United States and England. The articles are for the most part scientific and contain, among much other highly valuable matter, descriptions of 217 new species and varieties and 11 new genera in various orders of insects. The material contained in the volumes of our magazine is so important and necessary to scientific workers that there is a constant demand from various parts of the world for complete sets or separate volumes and numbers.

During the winter months classes were held fortnightly on Saturday evenings for practical instruction in the elements of entomology as a basis

for nature study work. They were attended by a number of teachers from the Public Schools in London as well as by other members of the Society The course was begun by Prof. S. B. McCready and after his appointment to the Macdonald Institute at Guelph, was continued by Dr. Bethune. When spring opened, the subject was changed to Botany, several outings to the country in the neighborhood were made, and the wild plants collected were carefully studied. Owing to various causes, especially to the absence or want of time on the part of the leaders, no formal meetings of the Sections were held. A number of popular lectures, illustrated by lantern pictures, were given by Dr. Bethune on insects and by Mr. W. E. Saunders on birds, under the auspices of various organizations in London and some of the neighboring towns.

Prof. Lochhead also has given lectures at several places on entomological and other subjects.

The reports from the branches of the Society at Montreal, Quebec and Toronto are highly satisfactory; great interest is taken in their proceedings by the local members and much good work has been accomplished.

The Council has much gratification in recording the formation of an active Branch in British Columbia, with head-quarters at Vancouver and an initial membership of eighteen; quarterly meetings are held and it is expected that, with so many energetic and enthusiastic members, rapid advancement will be made in the knowledge of the insect fauna of the Pacific Province.

To-day the Council has the additional pleasure of authorizing the formation of a Branch here at Guelph and welcoming the members to our annual meeting. The large number of members, no less than 24 at the outset and the presence of Professors and Students of the Agricultural College and Macdonald Institute, give the Branch a unique position and ensure its permanent success.

The Council desires to record its sorrow at the loss of one of its earliest Honorary members, Professor Alpheus S. Packard, M.D., who died at Providence, Rhode Island, on the 14th of February last. He was a distinguished entomologist, and author of a large number of books, both popular and scientific, on a variety of entomological and biological subjects; he also contributed from time to time to the "Canadian Entomologist." His name is held in high honour in Europe as well as throughout North America.

The Council has much pleasure in offering its hearty congratulations to Professor Lochhead on his appointment to an important position on the staff of the new Macdonald Institution at St. Anne's, P.Q., and has every confidence that, in his new sphere of active duty, he will continue to do good work in economic and scientific entomology and extend the influence of our Society.

To Professor Franklin Sherman, who has recently been appointed to the chair of entomology in the Ontario Agricultural College, the Council extends a cordial welcome, and feels assured that he will prove thoroughly efficient in his work and do much to encourage and direct his students in the earnest pursuit of this Department of Natural Science.

The outlook for the Society was never brighter or better, and the Council calls upon each member to do his share, in his own neighbourhood, in making investigations in insect life and extending the usefulness and influence of the Society.

All which is respectfully submitted.

John D. Evans,
President.

REPORT OF THE MONTREAL BRANCH.

The 267th regular, and 32nd annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 8th, 1905, at the rooms of the Natural History Society.

The following members were present,—A. E. Norris, (President); A. F. Winn; D. Brainerd; Alfred Griffin; L. Gibb; G. Chagnon; E. C. Barwick; G. R. Southee; S. Robinson; Chas. Stevenson; Geo. A. Moore; H. H. Lyman; and four visitors.

Minutes of April meeting were read and confirmed, and those of the last annual meeting were taken as read.

The President read the following

REPORT OF THE COUNCIL.

The Council in submitting this report feel encouraged in knowing that the Society is not only keeping up its honorable traditions, but is going ahead in a manner worthy of the strenuous times in which we are now passing. Nine regular meetings have been held during the year, the average attendance being a fraction over 7. Twenty-six papers were read, viz.

President's address, Chas. Stevenson.

A talk on Lycaenidæ, A. F. Winn.

Hydrœcias, illustrated by colored slides, A. E. Norris.

Leaf Hoppers, Fam. Jassidæ, G. A. Moore.

Pontia rapæ, n. var. rhaphanus, C. Stevenson.

Notes on Saperda, G. Chagnon.

Cydnidæ—Burrowing Bugs, G. A. Moore.

Mompha eloisella, A. F. Winn.

Notes on some types, and other specimens in the Br. Museum, H. H. Lyman.

The water-lily moth, A. F. Winn.

Notes on travel, with random observations on Entomology, H. H. Lyman.

Brief notes on breeding specimens of the past season, H. H. Lyman.

Cercopidæ, or Spittle insects, Geo. A. Moore.

Notes on Canadian species of Donacia, G. Chagnon.

Notes on Hemiptera for season 1904, Geo. A. Moore.

Stenopelmatus fasciatus—The sand cricket, A. F. Winn.

Small-headed fly—Pterodontia flavipes, Gray, Chas. Stevenson.

Report on annual meeting at London, H. H. Lyman.

Berytidae, or Stilt-bugs, Geo. H. Moore.

More about Micro Lepidoptera, A. F. Winn.

Notes on the species of Saperda in my collection, C. Chagnon.

New Gortynas, H. H. Lyman.

Criocephalus obsoletus and Asemum moestum, a correction, G. Chagnon.

Agamic reproduction in insects, A. F. Winn.

How to describe larvæ, H. H. Lyman.

Hemipterous nymphs, Geo. A. Moore.

Field days were held at St. Hilaire, Que., May 24th and July 1st and at the Maisonneuve Woods on April 21st, 1905.

At the annual meeting held at London, the branch was represented by Mr. Lyman.

During the year two new members were added to the Society.

Respectfully submitted on behalf of the Council.

(Signed), A. E. NORRIS,
President.

The Treasurer submitted his report, showing a balance on hand of $58.71.

Reports of the acting Curator and Libarian were presented, and on motion of Mr. Winn, seconded by Mr. Brainerd, were received and adopted.

Mr. Norris read his annual address.

The election of officers for the coming year resulted as follows:

President, A. E. Norris, re-elected.

Vice-President, Geo. A. Moore.

Secretary-Treasurer, A. F. Winn.

Curator and Librarian, Chas. Stevenson.

Council, E. Denny, L. Gibb; H. H. Lyman, G. Chagnon.

It was decided to hold a field day at St. Hilare on May 24th and that the Council should also arrange for a suitable place to spend July 1st.

Mr. Winn reported that the President of the Natural History Society had invited the Branch to attend their outing at Mount Johnston, on Saturday June 10th, and in order to encourage entomological collections moved, seconded by Mr. Chagnon, that the Branch should provide two books suitable for entomological prizes to the Natural History Society for the best collections made on that occasion.

Mr. Norris gave a talk on butterflies and moths, illustrated by original, colored lantern slides. He was assisted at the lantern by Mr. Griffin.

The meeting then adjourned.

(Signed), GEO. A. MOORE.
Secretary-Treasurer.

REPORT OF THE QUEBEC BRANCH.

The annual meeting of the Quebec Branch was held on the 8th day of November, 1905, at the house of the President.

There were present: The Rev. T. W. Fyles in the chair, the Rev. W. W. McCuaig, Lt.-Col. Crawford Lindsay, J. H. Simmons, Esq., Mrs. R. Turner, Mrs. Simmons, Mrs. Poston, Mrs. Fyles, Miss Hamel, Miss Freeman, Miss Bickell, Miss Hedge, Miss W. Fyles, Miss Russell.

The minutes of the last meeting were read and confirmed.

Mr. A. R. M. Boulton was elected a member of the Branch.

The President then addressed the meeting upon some of the noteworthy entomological incidents of the year: the alarmist articles in the public press upon the larvæ of *Orgyia antiqua* and *O. leucostigma;* the interesting discovery by Mr. C. W. Nash of Toronto of a fungus that takes possession of the wireworm, much as *Cordyceps melalonthae* does of the white grub; the abundance of the spiny caterpillars of *Cynthia cardui* upon the burdocks and holly-hocks; the appearance at Quebec, in great numbers, of the cotton moth, *Aletia argillacea;* late captures including that of *Catocala relicta* at the electric light, etc.

The officers elected were: President, Rev. Dr. Fyles; Vice-President, Miss E. Macdonald; Secretary-treasurer, Lt.-Col. Crawford Lindsay; Council, Hon. R. Turner, Rev. W. W. McCuaig, Mrs. Turner, Miss Bickell, Miss Freeman.

Hearty votes of thanks were passed to the President and the Secretary-treasurer and the hostess of the occasion.

REPORT OF COUNCIL.

The Branch now includes 25 members (22 adults and 3 juniors).

The Treasurer's report will be submitted and will no doubt be found satisfactory.

During the year interesting lectures were delivered by the President.

The Council regret to have to record the death of one of the members, Mrs. Morgan. A resolution of condolence was passed and forwarded to the husband of the deceased, Major James Morgan, and to her relatives.

Our thanks are due to the authorities of Morrin College for having continued to allow us to use their rooms for our meetings.

CRAWFORD LINDSAY,
Secretary-Treasurer.

REPORT OF THE TORONTO BRANCH.

The ninth annual meeting of the Toronto Branch of the Entomological Society of Ontario was held in the Provincial Museum, St. James's Square, on June 22nd, 1905.

The President Dr. Brodie was in the chair, and the following members were present: Messrs. Paul Hahn, J. B. Williams, R. Hallam, M. Hallam, J. H. Webb, Dr. E. M. Walker, J. H. Maughan, Junr., and Dr. Abbott.

The Secretary, Wm. John Maughan, Junr., read the following report.

"Your Secretary-Treasurer, has the pleasure to announce another year's statement of prosperity and advancement for 1904-5.

We have kept our membership up, and although some members have moved away, other new ones have joined.

The list of papers and lectures attached hereto have been splendidly descriptive and scientifically accurate, and not a few of them covered new and hitherto unknown material; some have been illustrated by lantern, others by specimens, charts, and drawings; putting before the members most completely all material connected therewith.

The attendance at meetings has been good, although the weather at times has not been propitious.

Your Secretary-Treasurer has also to announce that the Librarian-Curator has arranged and hung in the museum another large case of specimens, showing moths found in and near Toronto; also to thank members for their kind donations both of specimens and publications.

It is with sincere regret that your Secretary-Treasurer announces his withdrawal from the position he has held for some years past, and begs to thank the members, as a whole, for their kindness and courtesy shown to him on all occasions.

All of which is respectfully submitted.

(Signed) J. MAUGHAN, JR.,
Secretary-Treasurer.

List of papers read, 1904-5.

"The Leaf-cutting bee (Megachile brevis) and its Parasite", Dr. Brodie.
"A week at Lorne Park," J. B. Williams.
"Insects of North Ontario," G. M. Stewart.
"Galls of Oak," Dr. Brodie.
"Orthoptera," Dr. E. M. Walker.
"Scales on Butterflies Wings," J. B. Williams.
"The Tussock Moth and its Parasitical Life," Dr. Brodie.
"Dragon flies," Dr. E. M. Walker.
"A trip to Algonquin Park," Paul Hahn.

The following officers were elected for 1905-6:

President, Dr. Wm. Brodie.

Vice-President, Paul Hahn.

Librarian and Curator, J. B. Williams.

Council, Messrs. Leslie Walker, J. H. Webb, R. Hallam and Dr. Abbott.

Secretary-Treasurer, Mr. H. S. Saunders was elected, but he finds himself unable to accept the position, and another Secretary will have to be elected at the next meeting of the Society. Miss E. Blackmore, 242 Borden street, was subsequently elected.

The Treasurer's report shows the funds to be in a satisfactory condition with a balance of ninety cents on the right side.

GUELPH BRANCH.

The Guelph Branch at its meeting for organization has drawn up and adopted the following:

CONSTITUTION.

Article I. Name.

The name of this Society is the Guelph Entomological Society—a Branch of the Ontario Entomological Society.

Article II. Object.

The object of this Society is the increase and diffusion of the knowledge of insects.

Article III. Membership.

Section 1. Members shall be persons interested in insects. Members shall be elected by a two-thirds vote of the members present at any meeting.

Section 2. There shall be not less than six members resident in Guelph and vicinity.

Article IV. Officers.

Section 1. The officers shall be a President, Vice-President, and Secretary-Treasurer, elected at the annual meeting to serve one year.

Section 2. The President shall preside at the meetings of the Society. The President and the Secretary-Treasurer shall sign all written obligations of the Society.

Section 3. The Vice-President shall assume the duties of the President in the absence of the latter.

Section 4. The Secretary-Treasurer shall record the proceedings of the Society and of the Executive Committee, conduct correspondence, and make an annual report. He shall publish due announcement of the meetings of the Society. He shall be Curator of the museum of the Society.

Section 5. The Secretary-Treasurer shall have charge of the funds of the Society, and shall make collections and disbursements and render an annual report, and his accounts shall be audited by a committee of the society annually.

Section 6. All new officers shall begin their duties on the first day after the annual meeting.

Article V. Committees.

Section 1. There shall be an Executive Committee consisting of the President, Vice-President, Secretary-Treasurer, and a student appointed by the President.

Section 2. The executive shall constitute a standing committee on programmes, publications, admissions to membership, research and finance.

Section 3. The society shall elect a delegate to the annual meeting of the Entomological Society of Ontario.

Article VI. Finances.

Section 1. The fiscal year of the Society shall begin on the first day after the annual meeting.

Section 2. The annual dues of members shall be one dollar, payable at the annual meeting, and the dues for the first year shall be payable on signing the constitution.

Section 3. Members whose dues remain unpaid one month after they are due shall be notified by the Secretary-Treasurer that within one month they will be in arrears and not entitled to a vote at the annual meeting, to receive the publications of the Society nor of the Entomological Society of Ontario. Members one year in arrears shall, after formal notification by the Secretary-Treasurer, be regarded as having withdrawn from the Society.

Article VII. Meetings.

Section 1. Regular meetings of the Society shall be held on alternate Wednesdays from October to June.

Section 2. Special meetings may be called by the President.

Section 3. The annual meeting shall be held on the first Wednesday in October.

Section 4. Six members shall constitute a quorum.

Section 5. The Executive Committee shall hold its regular meetings on the same days as the regular meetings of the Society; special meetings may be called by the President.

Section 6. The regular meetings of the Society shall be open to all.

Article VIII. Publications.

The Canadian Entomologist shall be the official organ of the Guelph Entomological Society. *The Canadian Entomologist* and the reports of the Ontario Entomological Society shall be sent to all members not in arrears.

Article IX.

The Society shall maintain a Museum.

Article X. Amendments.

These By-laws may be amended by a two-thirds vote of the members present at any regular meeting, provided the proposed amendments have been read at the last previous regular meeting of the Society.

The following officers were elected for the year 1905-6: President, Prof. Franklin Sherman; Vice-President, Richard Readwin; Secretary-Treasurer, T. D. Jarvis; Executive Committee, Messrs. Sherman, Jarvis and Klinck.

REPORT OF THE LIBRARIAN AND CURATOR.

During the year ending August 31st, 1905, thirty bound volumes have been added to the Library, making the total number on the register 1,862; also a large number of periodicals and pamphlets. Among the new acquisitions may be mentioned the fifth volume, with plates, of Sir George Hampson's "Catalogue of Lepidoptera Phalænæ" in the British Museum. During the year 27 volumes were issued to local members.

A card catalogue according to subjects has been begun and all the bound volumes of pamphlets have been indexed in this way as well as a number of entomological bulletins and reports.

The collections have been increased by the kind contribution of 123 specimens of Coleoptera, including 113 species, by Prof. H. F. Wickham of Iowa City, who took note of the blanks in the cabinets when he visited the Society during the last annual meeting. The President, Mr. J. D. Evans, sent 50 specimens of beetles, including 16 species, new to the Society's collection. Mr. J. A. Balkwill throughout the summer has brought in a large number of specimens of various orders, especially Lepidoptera and Coleoptera, and Mr. J. A. Morden, of Hyde Park, has presented some rare specimens of nocturnal Lepidoptera, for all which the Society is deeply grateful.

The Curator would repeat his desire to receive specimens of almost all of our Canadian insects to fill blanks in the cabinets and to replace old and imperfect examples; also to have the specimens provided with labels giving the important information of locality and dates of capture, etc. Any member who has specimens to spare, and every one must have some, will confer a favour by first sending a list of those he is willing to present to the Society in order to prevent unnecessary duplication. The collections of Lepidoptera and Coleoptera from Ontario and Quebec are fairly complete, but in other orders the Society is very badly off.

The number of visitors is satisfactorily, advantage being taken of the opportunities to inspect the Library and collections during three afternoons in each week, when they are open to the public.

Respectfully submitted,

CHARLES J. S. BETHUNE,
Librarian and Curator.

REPORT OF THE TREASURER.

Receipts and Expenditures of the Entomological Society of Ontario for the year ending August 31st, 1905.

RECEIPTS.		EXPENDITURES.	
Balance on hand September 1st, 1904	$445 74	Annual Meeting and Report	$91 85
Members' fees	340 71	Salaries	275 00
Legislative grant	1,000 00	Postage, stationery, etc	146 29
Sales of pins, cork, etc.	43 59	Printing	753 77
Sales of Entomologist	174 10	Pins, cork, etc.	16 31
Advertisements	41 44	Rent	171 25
Interest	7 63	Insurance	48 80
		Library	32 18
		Balance on hand	517 76
	$2,053 21		$2,053 21

J. A. BALKWILL, Treasurer.

Audited and found correct.

F. A. STUART,
W. H. HAMILTON, Auditors.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

THROUGH JOHN D. EVANS, DELEGATE.

During the past year the Entomological Society of Ontario has drifted along in its usual even tenor, doing good work and progressing steadily and has passed the upwards of two score years of its existence.

The forty first annual meeting was held in October last, in its new, commodious and accessible quarters in the Public Library Building, Queen's Ave., London, the attendance being good, and among those present were four representatives of the gentler sex. From a distance may be mentioned the presence of Mr. T. N. Willing, Chief Inspector of Weeds for the Department of Agriculture, Regina, N.W.T., and from among our neighbors from across the border we gladly hailed the presence of an oft contributor to our magazine in the person of Prof. Wickham of the University of Iowa, Iowa City.

After the usual routine of business at the morning session the President opened the proceedings in the afternoon, at which the reports of the several Directors on the injurious insects of the year were read.

A feeling reference was made to recent death of the valued and faithful Curator and Librarian, J. Alston Moffat.

Mr. T. N. Willing presented a most interesting account of the methods inaugurated for the eradication of the noxious weeds in the North-west Territories, following which, Prof. Lochhead read his paper on the injurious insects of the year in Ontario.

The reports from the Toronto and Montreal Branches were also read.

A very largely attended and appreciative meeting was held in the evening in the Normal School presided over by Dr. Jas. Fletcher, at which Prof. Lochhead read his Presidential address on "Recent Progress in Entomology," and Prof. Wickham gave a most interesting lecture illustrated by a large number of beautiful lantern slides on "The Great Basin in the Western States and its Entomological Features."

The 35th annual report of the Society to the Legislature of Ontario has been presented in which is given a full report of all the papers read at the annual meeting. In addition to the afore-mentioned the following of the most important contributions may be enumerated, viz.,—

"Insects Injurious to Ontario Crops in 1904," and "Entomological Record 1904," by Dr. Fletcher.

"Further Notes on Basswood or Linden Insects," and "Notes on the Columbine borer," by Arthur Gibson.

"Insects Collected at Light during 1904," by J. D. Evans.

"Spining Methods of Telea Polyphemus," by J. W. Cockle.

"Insect Names and Insect Lists," by J. W. Williams.

"Notes on the Season of 1904 in Quebec," by C. Stevenson.

"Insects Affecting the Oak," and "On the Food-Habits of Certain Hymenoptera," by T. W. Fyles.

"An Elementary Study of Insects," by Wm. Lochhead.

"The Pear Tree Psylla and How to Deal with It," by G. E. Fisher.

Obituary notice of the late John Alston Moffat.

The foregoing is termed the annual report; in addition to this is published monthly the magazine, *The Canadian Entomologist*, now in its 37th year.

The 36th volume (being for 1904) consists of 367 pages, has four full-page plates and a number of cuts from original drawings. The contributors are 63 in number, embracing thirteen Canadian, thirty-nine in the neighboring Republic and one in England.

The papers cover all the important orders of insects, such as Lepidoptera, Hymenoptera, Diptera, Coleoptera, Orthoptera, Hemiptera, and Neuroptera, throughout which are described 217 new species and varieties and 11 new genera.

The papers being too numerous (being upwards of one hundred, besides numerous short paragraphs, book reviews and obituary notices,) to designate all by title; a few of the more important may be mentioned such as,—"Classification of the Fossorial, Predaceous and Parasitic Wasps, or the Super-family Vespoidea," by Wm. H. Ashmead; "Several New Diptera from North America," by D. W. Coquillett; "Notes on North American Stratiomyidæ," by A. L. Melander; "New Noctuidæ from British Columbia," by Harrison C. Dyar; "Synopsis of Anthopila," by Charles Robertson; "The Diptera of British Columbia," by James S. Hine and Raymond C. Osburn; "Synopsis of Bees of Oregon, Washington, British Columbia and Vancouver," by H'y. L. Viereck, *et al.*; "New Tortricids from Kaslo, B.C., and the Northwest," by W. D. Kearfott; "Descriptions of Some New Species and Varieties of Canadian Butterflies," by Dr. Fletcher; "The Crickets of Ontario," also "Notes on the Locustidæ of Ontario," by E. M. Walker; "New Noctuidæ for 1904," by Prof. John B. Smith; "New Species of North American Lepidoptera," by Dr. Wm. Barnes; "Synopsis of Prosopis and Colletes with Supplementary Notes and Descriptions," by Charles Robertson; "New Species of North American Asilidæ," by E. A. Back; "On Some New Coleoptera, Including Five New Genera," by Thos. L. Casey; "A Review of Our Geometrid Classification," by Richard F. Pearsall.

"The British Columbia Entomological Society" has recently become affiliated with us and is now the *B. C. Branch* of the Entomological Society of Ontario. Thus are we "lengthening our cords and strengthening our stakes."

During the winter months regular classes have been held fortnightly in London for the study of entomology under the direction of Mr. S. B. McCready, Science Master of the London Collegiate Institute and now Nature Study Professor at the Macdonald Institute, Guelph, assisted by Dr. Bethune.

These meetings have been well attended, chiefly by teachers in the public schools of the city.

Similar instruction has been begun in botany and will be carried on during the summer, excursions being made for specimens to different parts of the surrounding country.

A number of lectures illustrated with lantern pictures on noxious, beneficial and interesting insects have been given by Dr. Bethune in London and a few places in the neighborhood.

Prof. Lochhead of Guelph has given lectures on similar subjects in Hamilton and elsewhere.

The Library and collections of the Society are open to the public on three afternoons in each week and attract a fair number of visitors.

AFTERNOON SESSION.

Thursday, October 19th, 1905.

The Vice-President, Dr. Fletcher, took the chair at 2.30 o'clock, p. m.; there were about eighty persons present. The first business of the session was the election of officers for the ensuing year, which resulted as shown on page 2.

Prof. SHERMAN, who has been recently appointed to the chair of Entomology at the Ontario Agricultural College, on being called upon, said that his duties were confined to entomology in all its bearings and departments, now that is was separated from the teaching of botany and other subjects. Among other objects he had especially in view the formation of a representative collection of the insects of all orders to be found in the Province of Ontario, and a catalogue giving dates, localities, etc. He intended that every specimen should be properly labelled so as to give all necessary data regarding it, and he exhibited some recent captures showing his method of labelling. He expected that the Entomological Society would help the College and the College would certainly help the Society.

The Chairman then read the annual address of the President and expressed the regret that was felt by all at the absence of Mr. Evans.

ANNUAL ADDRESS OF THE PRESIDENT.

BY JOHN D. EVANS, C.E., F.L.S., TRENTON.

It is with the utmost diffidence that I presume to present to you this, the President's Annual Address, on this auspicious occasion, being the first meeting of the Society at the fountain-head of economic entomology for the Province of Ontario, the Ontario Agricultural College at Guelph.

Owing to pressure of official duties in my professional capacity for some months past, it has been quite impossible for me to prepare anything upon a special subject bearing upon the all-absorbing, instructive and useful pursuit, the study of insect life. I trust, therefore, you will kindly bear with me in the few brief remarks I may have to make and pardon me for not providing you with the intellectual treat you are usually regaled with upon like occasions.

We have met together to transact the (always) important duties attendant upon the annual meeting, and we should heartily congratulate ourselves upon having reached the 42nd annual gathering of the Society without a break or misstep either in its annual meetings or publication of its magazine for such a length of time. It is the oldest extant on this continent, I believe, save one, and is held in the highest esteem not only over the length and breadth of this continent, but also in the remote parts of the Old World. And its publication (the monthly magazine) includes among its many contributors most of the leading specialists from among our very helpful neighbors across the border, as well as occasional ones from the other side of the salt water. Nor should we omit to refer to the annual reports of this Society to the Ontario Department of Agriculture, now numbering thirty-five, which are replete with the most useful information regarding the life histories of insects, the methods of dealing with the injurious ones, and preserving the garden, orchard, and farm crops from their ravages. These reports are very much sought after, not only by those for whom they were especially prepared (the sufferers), but also by the entomologists and entomological societies the world over.

Great strides are being made in the study of the insect fauna generally, but more especially has attention been directed of late to some of the, heretofore, most neglected orders, the Orthoptera and Diptera coming well to the front, particularly the last mentioned, which has been recently catalogued by Prof. J. M. Aldrich of the University of Idaho, the species now numbering 8,300 as against 2,500 catalogued in 1878 by Baron Osten Sacken and following closely, numerically, the Coleoptera and Lepidoptera.

Among many other assiduous workers in the field on this continent who are doing good work, adding largely to the knowledge regarding their several specialties, may be mentioned Dr. J. B. Smith in the Noctuidæ, Rev. Geo. W. Taylor in the Geometridæ, and Mr. W. D. Kearfott in the Micro-Lepidoptera.

We are deeply indebted to a large number of the American specialists, among whom may be mentioned Dr. L. O. Howard, Dr. Harrison G. Dyar, Mr. D. W. Coquillet, Dr. W. H. Ashmead, Dr. Henry Skinner, Mr. E. P. Vanduzee, and Prof. H. F. Wickham, for their many patient and self-sacrificing acts in examining and naming species in the various orders for the Canadian collectors and students.

Much literature on entomological subjects has been produced during the past year, but foremost among them may be classed "American Insects," by Prof. V. L. Kellogg, of Leland Stanford, Jr., University, which is profusely illustrated with colored plates and figures in the text and provides a very valuable work for the use of nature observers, natural history students, and of general readers. Also in this category may be added "A Synonymic Catalogue of the Erycinidæ of the World," by Levi W. Mengel of Reading, Penn.

We are sorry to learn that our worthy Past-President and genial and indefatigable worker, Prof. W. Lochhead, is about to withdraw his valued services from the Ontario Agricultural College to become the Entomologist at the new Agricultural College at St. Anne's, Que., which has been founded by Sir Wm Macdonald, but although he may be somewhat further removed geographically, still we hope to always have his presence at our meetings in the future and counsel in matters pertaining to the welfare of the Society, and help and assistance in time of need. We have no doubt that his successor, Prof. Sherman, a student under Prof. Comstock, and of much experience, will prove to be the right man in the right place, and carry on the work at the College in the same thorough and painstaking manner as has been done under the regime of his predecessor.

The passing season has been, so far as I am aware, and from my own experience and observation, a very poor one for insects, generally speaking very wet, somewhat similar to the two last preceding seasons. Consequently insect life in many ways has not flourished. The forest tent caterpillar (*C. disstria*) seemingly has disappeared entirely and the presence of the Fall webworm (*H. textor*) very rarely seen.

The County of Prince Edward and the surrounding district has been noted in the past for large crops of high grade pease, but of late years the Pea-weevil (*B. pisi*) has been so destructive that the crop has been almost ruined. A great warfare has been waged against this insect pest through the instrumentality of the leading members of this Society, to wit, the active workers in this department at the Central Experimental Farm at Ottawa and the Ontario Agricultural College at Guelph. For about two years the pea crop was almost eliminated from the farming community with the hope that the shortness of the food plant would wipe out the pest. This apparently has come to pass, for this year again a very large acreage has been sown, resulting in a most bountiful crop with very little, if any, ill effects from the weevil. It

is to be hoped now that those interested will take to heart a lesson from past experience and use all the means available, which have been so thoroughly advertised and disseminated by the officers above-mentioned throughout the length and breadth of the country, so as to keep the pest within due bounds.

I learn that the San Jose Scale and Codling moth are also well under control by means of the spraying methods practised under the leadership and guidance of the afore-mentioned officers through the instrumentality of this Society.

The White Cabbage butterfly (*P. rapæ*) and Yellow Clover butterfly (*C. philodice*) have been very numerous in places late this season, but they have not apparently done any serious damage.

Nature study is a subject gaining much strength and being taken up among the schools all over the country, and is now one of the subjects recommended by the Educational Department of Ontario. Steps are being taken at this time to take up the subject in the Trenton schools, and its rootlets have taken hold in most remote outlying districts, even to the most northern extremity of this County of Hastings.

This subject has repeatedly been brought before the notice of the public by various members of this Society, lectures having been given in London and various places in the neighborhood, at Guelph, Hamilton and elsewhere, by Dr. Fletcher, Dr. Bethune, Prof. Lochhead, Prof. McCready, and others. Particular mention must be made of Prof. John Dearness, who has recently produced "The Nature Study Course," a book designed for the use of those interested in the education of the young, both boys and girls.

In furtherance of this most commendable study, reference should be made to an illustrated paper, "Practical and Popular Entomology," "Entomology in Schools," by Mr. H. S. Saunders, of Toronto, which appeared in our magazine in the February issue of this year, as being deserving of emulation by other members of our Society.

After the remaining papers on the programme had been read and discussed (they will be found in succeeding pages of this report), President Creelman expressed the pleasure which it had given him and the members of the College to have the annual meeting of the Society in their buildings, and on behalf of the students in Biology, the Wellington Field Naturalists' Club and the Entomologists, he asked the Society to meet at the Guelph College as often as it possibly could.

Prof. H. L. Hutt joined in this expression of gratification and said that he had been especially pleased to meet and make the personal acquaintanceship of many veteran entomologists whose names had long been familiar to him.

Prof. Lochhead spoke of the importance of this meeting to the students, who would receive a lasting inspiration from it.

Votes of thanks were unanimously passed to President Creelman and his staff for their kindness and hospitality; to Prof. J. B. Smith for his welcome visit and most interesting lecture; and to the reporters of the Toronto *Globe*, the Guelph *Herald* and *Mercury*, and the Toronto *Weekly Sun*, for their excellent accounts of the proceedings.

INSECTS AS NATURE STUDIES.

By S. B. McCready, Professor of Nature Study, Macdonald Institute, Guelph.

My interest in this topic is not that of an entomologist, but that of the schoolmaster. To the student of insect life nothing, perhaps, is more natural as nature studies, than insects; nothing perhaps is more likely to awaken readier interest and develop powers of careful observation; nothing in animal life has much, if any, greater concern with our lives. But while our teachers are quite ready to acknowledge that the study of insects may profitably be admitted to a place amongst the multitude of school studies, they are, as a class, quite at a loss to know how to commence the study of them. They feel afraid, or helpless, or rebellious, or indifferent. They feel that they have been imposed upon; they have been trained and accepted into a work which is suddenly changed; sometimes it is hinted that their inability to handle the work is through fault of theirs to readily adjust themselves to new conditions; in fact through insects and the other "what-nots" of nature studies, the conscientious teacher's burden has become considerably heavier in these later days.

Here are the insect studies prescribed for Manitoba schools, *e.g.*:

Grade I. Butterflies and moths. Reference to color, beauty, movements, etc.; study of simple life-history of butterfly or moth; preparation for winter by insects.

Grade II. Observation of habits of the ant, bee, wasp, and grasshopper.

Grade IV. The House moth. The eggs, the larva, the cocoon and pupa, the imago, the egg; or the study of a wasp in nest making, feeding young, guarding young, and in winter season.

Grade V. Insect life in relation to the shade trees; aphis, caterpillar and leaf gall of maple suggested; rearing mosquitoes and butterflies from eggs in order to obtain life histories; recognition of lady-bird beetle with a view to protecting it. Finding the larvæ on trees infested by aphids; observation of insect life in an old log, a rotten stump, a sand hill; incidental observation of insect life.

Grade VI. Interdependence of insects and flowers; special study of grasshoppers; finding the eggs, observing young hoppers, and growth of their wings; the most favorable weather, food how eaten, behaviour in wet and windy weather, etc.

Grade VII. Cockroach and field insects. Simple classification of insects according to character of wing.

Grade VIII. Insects of field, Bee.

This is the outline of insect work for the Manitoba teacher in the Public Schools, and is like that for Ontario schools, except that it is more specific—the Ontario outline is expressed in general terms *e.g.*, in Form IV. the work is life histories of conspicuous and economic insects; organs and functions.

With most teachers, even those who have had advantages of University training, there has never been an awakening of interest in insect life—life histories, moths and butterflies, aphids, beetles, larvæ, galls, caterpillars, cocoon, pupa, imago, egg—such terms mean very little, if anything. They are cut off from helping themselves as they may do in other subjects; the work demands actual personal observation if it is to be rightly presented; they cannot read ahead of their classes as in history, geography, and arithmetic and make proper presentation of the subject; it isn't in books, in fact it needs quite another kind of adjustment, a humiliation, a really putting of

oneself into the child's position and attitude. This is hard. No other subject demanded it, the teacher has, in many branches of school work, grown away from the child's atmosphere, but here it is only by becoming as a little child that success may be won.

But while the teacher is learning of insects in this way it is slow, and with the demands of other studies upon him, disheartening; advanced classes will be demanding greater knowledge than patient independent investigation could attend to in many years,—the teachers must be helped; in the multiplicity of text-books there is confusion, even if they should be able to secure them; and many of the books are more hinderance than help on account of being over technical or too exhaustive; the school inspectors can very seldom help much, and without help from books, or superintendent, the teacher may be unintentionally working harm to a good cause; may in striving for the same end in nature study as he does in many other subjects—the acquirement of facts—defeat its chief purpose—the development in our boys and girls of a sympathetic, patient, independent outlook on nature.

The Entomological Society of Ontario and its members can do a great deal to help on the work—as indeed they have done already.

There should be some means adopted by our Department of Education whereby articles such as that of Dr. Fletcher's on the Clover Butterfly, published in the Ottawa *Field Naturalist*, and the articles on economic insects appearing in our Annual Reports, could be put into the hands of every school teacher and school inspector in Ontario, and *free, it has to be free*, and with clear instructions for adapting the work to the schools. There is a large field of usefulness for our *Canadian Entomologist* in offering through the Department of Education special articles in insect studies suited to our schools. At the present juncture, since travelling instructors or local centres of instruction are impracticable, and the University is not helping, these are the best means I can think of for helping our teachers, and our boys and girls in a rather puzzling situation.

NOTES ON THE SEASON 1905 (WESTERN QUEBEC).

By Charles Stevenson, Montreal.

Insect collecting this season has been interesting on account of the quantities of several species of butterflies that appeared. But it has been somewhat disappointing in the captures of rare species and varieties.

In Lepidoptera our old friends *Vanessa atalanta*, Linn., *huntera*, Fab., and *cardui*, Linn., have been very plentiful: in fact in some localities more prominent than the common *Pontia rapæ*, Linn., and *Eurymus philodice*, Godt., the *Albinic* variety of the latter being prominent. Over twenty-five specimens were captured by Messrs. G. Chagnon, E. Denny and myself on the 28th Sept., in a small patch of ground in Outremont, near Montreal. The one-time-common *Anosia plexippus*, Linn., which had almost disappeared last year, showed up more frequently. A fine fresh specimen was caught as late as the 3rd Oct., near Montreal.

Owing to the activity of the collectors this year, four separate localities around Montreal are now known to be frequented by *Stenopis thule*, Strecker,

Great prominence was brought before the public of Montreal by the ravages of the Tussock moths. Three species were found, *Notolophus antiqua*, Linn., *Hemerocampa leucostigma*, S. & A., and *definita*, Pack., *leucostigma*

being the most plentiful and *antiqua* rare. Considerable amusement was given to the entomologists by the ridiculous methods adopted by the authorities to exterminate them, the chief one being to scrape the egg-masses off the trees and leave them on the ground.

Good work has been done by Mr. E. Denny in rearing caterpillars, especially in procuring varieties of *Apantesis vittata*, Fab., and great credit is due to this gentleman for his patience and perseverance in bringing other lepidoptera larvæ to maturity.

Mr. G. A. Moore continues to do good work in the study of Hemiptera.

Messrs. H. H. Lyman, A. E. Norris, and A. F. Winn have continued their studies of the life histories of the *Gortynas*.

Mr. G. Chagnon has made a specialty of the *Buprestidæ* and *Cerambycidæ* of the world, and has built up a collection of these insects which is well worth seeing. At the same time he has not neglected the local fauna of Coleoptera, besides which he has commenced a collection of local *Lepidoptera*, taking particular interest in the *Geometridæ*, in which group we hope to see him have a companion in Mr. G. A. Southee, who has recently become an enthusiastic collector.

It is a pleasure to record the interest that is being aroused among the younger folk, not only in making collections but also in the economic value and the life histories of the specimens they capture. Special mention may be made of the steady work of Masters G. R. Southee, Arthur Denny, T. S. Robinson, H. G. Roche, and Roland Desjardins.

I myself have little to record, owing to my having been severely handicapped by the loss in the spring of my helpmate. However, I have added to my list of local *Blattidæ* several specimens and have been making a special study of ecological entomology, and hope to give my observations at an early date. I may mention, in reference to this subject, that *Sporotrichum globuliferum*, Speg., has been quite epidemic in this locality, and that *flacherie* has dealt great destruction among the caterpillars of *Malocosoma Americana*, Harr.

The following interesting captures may be mentioned:—

Erora laeta, Edw., St. Hilaire, Que., 24th May. E. C. Barwick.

Enodia portlandia, Fab., Mt. Johnson, Que., 10th June. Charles Stevenson. (Fig. 16.)

Apantesis vittata, Mt. Johnson, Que., 10th June. E. Denny. (From which he obtained a batch of eggs, which he successfully brought through to maturity and obtained a splendid series of varieties. He succeeded in mating some of the imagoes and got more eggs, which are now full-grown caterpillars.)

Calosoma scrutator, Fab., St. John's, Que., 30th July. G. Chagnon. (Fig. 17.)

Hydræna pennsylvanica, Kies, St. Anne de Bellevue, Que., 23rd July. G. Chagnon.

Haltica rufa, Ill., St. Hilaire, Que., 27th June. G. Chagnon.

A report of the entomological work of this locality would be incomplete without making an acknowledgment of the lady friends of the collectors, especially Mrs. E. Denny and Mrs. G. R. Southee, for their assistance and encouragement of the insect-hunting hobby.

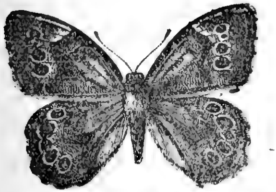

Fig. 16. Enodia Portlandia, the Pearly-eye butterfly.

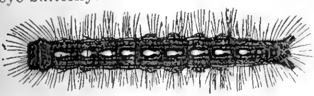

Fig. 18. Forest Tent-caterpillar.

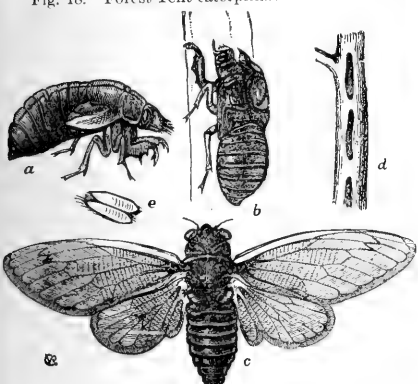

Fig. 22. Cicada : *a* pupa, *b* empty shell, *e* eggs, *d* slits made in twig for eggs, *c* mature Cicada.

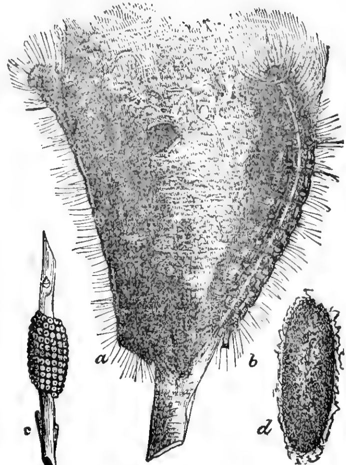

Fig. 19. Orchard Tent-caterpillars on their web : *c* egg-bracelet ; *d* cocoon.

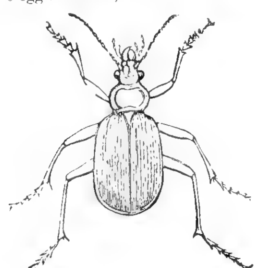

Fig. 17. Calosoma scrutator, the Green Caterpillar-hunter beetle.

Fig. 20. A Hawk-moth (Sphinx) caterpillar.

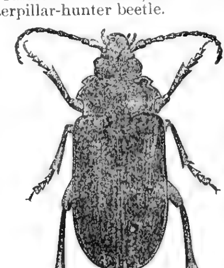

Fig. 21. Prionus laticollis beetle.

FOREST INSECTS.

By Rev. Thomas W. Fyles, D.C.L., F.L.S., Levis, Que.

Insects fall naturally under two heads.—biting insects, Mandibulata, and sucking insects, Haustellata. To the former belong the borers in the tree-trunks, the twig-girdlers, and the leaf devourers; to the latter, the Cicadas, the scale insects, and the plant lice. It is difficult to tell which of the two orders is the most hurtful to vegetation. In "God's great army" the most insignificant corps becomes occasionally by force of numbers, a formidable array.

In the summer of 1881, the maples presented a strange appearance. Their foliage became brown and withered, as if autumn had come before its time. On examination it was found that countless multitudes of the larvæ of a minute species of moth, *Depressaria acerifoliella*, had assailed the foliage.

The larva of this species bites disks from the leaves and binds them together with a silken filament, so constructing a case for itself. It protrudes its head and forelegs from its case and moves about the leaf, eating away the fleshy parts.

In 1893 another remarkable insect attack upon the maples was witnessed: nearly every leaf of the trees was drawn out of shape—its edges being fastened together with a fine web. Within the tent thus formed was a curious brown case, somewhat in the form of a cornucopia, and snugly ensconsed within the case was a green larva with an amber-colored head. This truly was one of the most economical of insects. Longfellow has said:—

> "O thou sculptor, painter, poet!
> Take this lesson to thy heart:
> That is best which lieth nearest,
> Shape from it thy work of art."

And this larva had used up its exuviae and excrement in forming a case for itself—an inner retreat. The leaf was its shelter and store of food; for it fed upon the parenchyma, and left only the veins and skin. The case was its stronghold. The name of the insect is *Semasia signatana*.

Our native insect pests are bad enough; but the insect foes that we most dread are the foreigners, for the reason that "it is better to deal with the devil you know than the devil you don't know."

The advent of the Larch Saw-fly (*Nematus Erichsonii*) is an old story now. This pest destroyed our tamaracs in the eighties, and it

> "Still goes marching on."

Mr. A. H. D. Ross, in his excellent article on "The Forest Resources of Labrador Peninsula," tells us that of late years the European Larch Saw-fly has destroyed most of the larch between Lake St. John and Lake Mistassini, and the pest is spreading northward.

The Gypsy moth, the Brown-tail moth, and the Leopard moth are new importations to the country to the south of us.

So great a plague has the Gypsy moth been in Massachusetts that the Legislature in four years (1890-4) expended $275,000 in the effort to exterminate it, and had not succeeded; and further appropriations were required.

The larva of the Brown-tail moth is also injurious in Massachusetts, and as their fine barbed hairs are easily detached and carried in the air, they often settle upon the passers-by, work their way into the pores of the skin and cause much suffering. They are greatly to be dreaded.

The larvæ of the Leopard moth are borers. The species has found its way to New York.

In Canada a very common and mischievous pest is the Forest-tree tent caterpillar (*Clisiocampa disstria*). This also flourishes more abundantly some years than others. In 1899 it and its congener, *Clisiocampa Americana*, were so abundant in the Counties of Drummond and Shefford that they stripped the second growth trees bare. Hordes of them crossing the railway brought the train to a standstill, the rails having become slippery with crushed larvæ.

The larva of *C. disstria* (the Forest tent caterpillar) can readily be distinguished from that of *C. Americana* (the Orchard Tent caterpillar). It has a blue head, and a row of silvery spots down the back (Fig. 18), while the other has a black head and a continuous dorsal line (Fig. 19). I consider *C. disstria* the worst of the leaf-eating foes of our hardwood trees.

The larvæ of *Orgyia antiqua* and *Orgyia leucostigma* are handsome but mischievous. They are beautifully tufted along the back. (Fig. 4.) Those of the latter species may be known by their red heads. Both kinds feed upon a variety of forest trees.

The males of these species are called "Vapourers" because of their jaunty flight. They skip hither and thither, as Wood says, "like Cœlebs in search of a wife." The females, on the other hand, are most exemplary in their behaviour. St. Paul, if he had been an entomologist, would have admired them greatly—they "go not from house to house," they stay at home and mind their own affairs. They remain upon the cocoons, from which they crept. There they await their mates; there they lay their eggs; and there they die. But we must not give them too much credit for their domestic virtues. They are aided by the force of circumstances in conducting themselves well—they have only rudimentary wings. (Fig. 7.)

There are a number of large moths, the larvæ of which under peculiar circumstances might become injurious to forest trees. Their very size makes them formidable. (Fig. 20.) The larvæ of the Hawk-moths, *Sphinx chersis* and *Sphinx kalmiæ*, feed upon the ash, though I frequently find them on the lilac. This is not surprising, for both the lilac and the ash belong to the same family of plants, the Oleaceæ, of which the olive tree is the type.

The larva of *Ellema coniferarum* feeds upon the pine. I wish the species were a little more common, for I have only met with one specimen in many years.

The larvæ of *Ceratomia amyntor* feed upon the elm. They have four prominent horns on their shoulders; and Harris on this account gave them the name of *Quadricornis*. There are peculiarities in the form and habits of this species that are well worth notice.

It will be remembered that the leaves of the elm on the under side are strongly and regularly ribbed, and that they are often curled over on one side in a roll. The Amyntor caterpillars are of the same color as the leaf, and along the sides have seven oblique, raised, rough lines. They lie extended along the edge of the leaf, and in that position very closely resemble the roll of the leaves near them. Nor is this all. In the autumn the leaves of the elm become rusty brown in colour, and that the resemblance to the leaves may be maintained, the caterpillars become of the same hue. They afford in this a rmarkable instance of what is called Mimetic Analogy.

The larva of that stately moth, *Triptogon modesta*, feeds upon the poplar, and that of *Cressonia juglandis* upon the black walnut, the butternut and the hickory.

Upon a variety of forest trees, the larvæ of those magnificent Saturnians, *Attacus cecropia* (the largest of our moths), and *Telea polyphemus* are

to be found, whilst those of *Actias luna* (the most beautiful) feed upon the butternut, and those of *Hyperchiria Io* upon the elm, the basswood and the balsam-poplar. The last-named larvæ are set with stinging spines.

In the West the larva of that splendid moth, *Eacles imperialis*, feeds upon the white pine; and the larvæ of *Citheronia regalis*, which has as many horns as the Beast in the Apocalypse, and is locally known as the "Hickory Horned Devil," feeds upon the black walnut, butternut, hickory, etc. I have never heard, however, that the caterpillars of these very large insects have done much damage.

Of insects that injure the roots of the trees, these are remarkable:—

The White Grub: This is the larva of the May Beetle, *Lachnosterna fusca*. (Fig. 6.) The grubs of this species are very general feeders upon the roots of plants. They are said to be injurious to young pines and tamaracs.

A formidable foe to the poplar, basswood and oak, is *Prionus laticollis*, the Broad-necked Sawyer which bores into the roots of trees. As it works underground its ravages are not easily detected. (Fig. 21.)

But of the underground insect foes of the forest trees, the Cicadas are, I think, the worst. Happily this part of Canada is out of the range of *Tibicen Septendecim*, which spends seventeen years at the roots of trees, imbibing at the very founts of vegetable life. But *Cicada canicularis* is very abundant with us. If you go into the woods in autumn you will hear the shrill sound produced by their little tambours or side drums, which vibrate, as the boys say, "for all they are worth." We have another species, *Tibicen rimosa*, but it is not common with us.

The habits of the Cicadas are interesting. The females cut grooves in the twigs of their favorite trees, and in each groove lay a row of eggs. The eggs seem to be nourished by the sap in the twigs, for they become enlarged. The newly-hatched larvæ drop to the ground and burrow till they reach the roots of the trees. Into these they drive their beaks, and then, for three years, live by suction upon the sap. At the end of that time they work their way out of the earth, climb for a short distance up the trees, and then writhe and twist till their skins burst down the back. Out of the rent, in every case, creeps a perfect insect, drawing its legs out of their former enclosures as out of boots. In about ten minutes (I have watched the process) the air has penetrated to every part of the insect's body, its wings have been shaken out of plait into their full dimensions, and the creature is ready for flight. (Fig. 21.)

If you ask me what should be done to check the Cicadas, well, I know what I should do as regards the orchard, the sugar-bush and the enclosed woods. I should in the autumn turn a herd of swine into them. The animals would not only eat the windfall apples, the acorns and beech-mast and fungi, they would grub about the roots of the trees, and devour the immature Cicadas, the White Grubs, and the pupæ of many kinds of flies, beetles and moths. I have seen the experiment tried, and the pigs throve.

But a part of my subject of more interest to lumbermen is that relating to the "Borers"—and truly their name is legion.

A number of beetles belonging to the family Buprestidæ bore in the pine. Two splendid beetles of this family are *Chalcophora Virginiensis* and *Chalcophora fortis*.

C. fortis is the largest and handsomest of our Buprestidæ, and, perhaps, as regards our collections, the rarest. Mr. H. Hague Harrington speaks of it as rare at Ottawa, and I never met with it at Montreal, nor in the Eastern Townships; but one day I was walking under the cliff, at Hadlow, on the south side of the river, when I found specimens of both *C. Virginiensis* and *C. fortis*. There were no trees near in which they could have bred, and the in-

sects were fresh and perfect. The discovery was a marvel to me till, on looking to the river side, I saw, stranded, a crib of pine timber; and then the mystery was solved. This incident shows how easily insects may be spread over the country.

There is a beetle called *Monohammus titillator.* (Fig. 23.) This beetle and its congener, *Monohammus scutellatus* (Fig. 24) make damaging tunnels in the trunks of the pine; and they sometimes turn up unexpectedly in places far from their native forest.

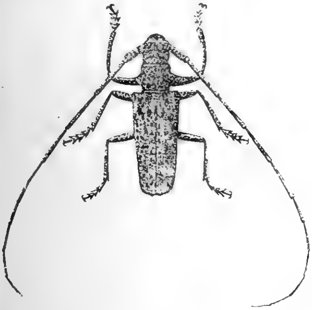

Fig. 23. Monohamus titillator, Pine-borer beetle.

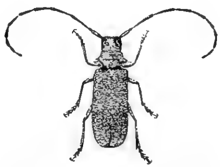

Fig. 24. Monohammus scutellatus.

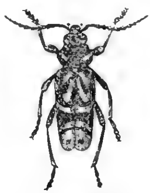

Fig. 25. Plagionotus speciosus, Maple-tree borer.

The larva of *Plagionotus speciosus* (Fig. 25) is a borer in the maple. That of the fine beetle *Saperda calcarata* bores in the poplar. The Apple-tree borer, *Saperda candida* (Fig 26) works also in the American mountain ash and the thorn. The larvæ of *Saperda vestita, Saperda tridentata* and *Cyllene pictus* bore respectively in the basswood, the elm and the cedar (*Thuja occidentalis*).

Time would fail me to enumerate the small beetles which mine between the bark and the white wood, and which at times do much harm—volumes might be written upon them.

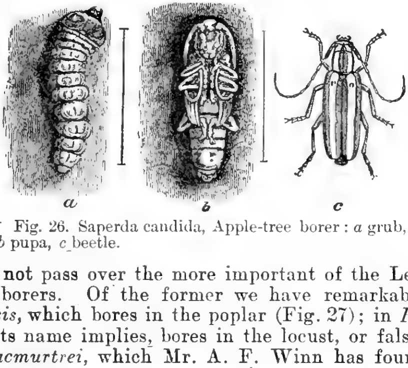

Fig. 26. Saperda candida, Apple-tree borer: *a* grub, *b* pupa, *c* beetle.

But I must not pass over the more important of the Lepidopterous and Hymenopterous borers. Of the former we have remarkable instances; in *Cossus Centerensis,* which bores in the poplar (Fig. 27); in *Prionoxystus robiniæ,* which, as its name implies, bores in the locust, or false acacia; and in *Prionoxystus Macmurtrei,* which Mr. A. F. Winn has found upon oaks on Mount Royal.

The larva of several species of Clear-wing moths are borers; *Sesia acerni* in the soft maple, *Sesia pictipes* in the wild cherry, *Pseudohazis denudata* in the ash.

The Horn-tail, *Tremex columba,* or Pigeon Tremex (Fig 28), is a creature of formidable appearance. It has a stout acuform, but hollow, ovipositor which extends in its sheath from the middle of the underside of the abdomen to a length of half an inch beyond the body. The Tremex drives this instrument through the bark and into the soft wood of the tree (which is usually a maple or a beech), and then, by muscular action, it passes its eggs through the ovipositor to the end of the wound it has made. The Tremex is, in many instances, so exhausted in the process that it has not strength to withdraw its ovipositor, and perishes at its post.

As soon as the young larvæ are hatched they begin to tunnel in different directions, enlarging their passages as they grow.

Other Horn-tails of like habits to the Tremex are *Sirex albicornis, Sirex flavicornis,* and *Paururus cyaneus,* and these assail the pine.

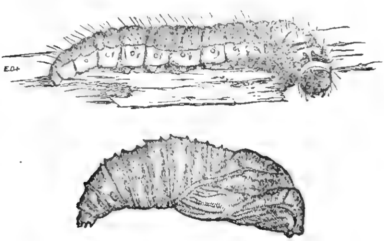

Fig. 27. Wood-boring caterpillar (Cossus) and chrysalis.

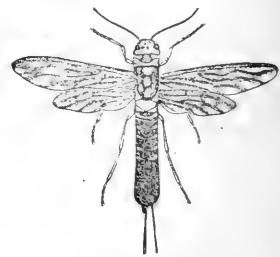

Fig. 28. Pigeon Tremex — the Horn-tail borer.

It must not be supposed that nature has left these borers to multiply and work their will without a check. If she had, the forests would have disappeared long ago. No—a number of formidable Ichneumon flies, with yet longer ovipositors, are engaged in reducing the hosts of the enemies.

Indeed every kind of destructive insect has its foes. Insectivorous birds and predaceous insects, under ordinary circumstances, keep the spoilers within bounds. And man may give his assistance to nature to the same end. For instance, he can preserve the woodpeckers and the soft-billed birds. The man who would shoot a woodpecker ought to be ostracized. I wish I could hear more frequently the hearty laughing call of that noble bird the Bonneted Woodpecker, *Picus pileus.* Alas, its beauty has been to it a "fatal gift." It has drawn the attention of the fowler.

There should be a law forbidding juveniles to carry guns. There is this to be said, these gun-bearing boys lessen their own numbers. Many a young rascal will go into the woods and think he has done a clever thing if he has brought down a Wakeup or a Tom-tit.

When a tree is found with Horn-tails affixed in the position I have mentioned, it may be known that that tree is doomed; it should be felled and split up for stove-wood.

The proper and timely burning of brush-piles will do much to lessen the numbers of insects. Brush should be burned, not when the ground is covered with dry herbage and dead leaves, but when vegetation is lush and green, and then the fire and smoke would destroy their thousands of insect pests.

In Europe in former days foresters were men of standing and importance. It seems to me that it would be a good thing if our Government would appoint in every county in which lumbering operations are being carried on and settlements made, Government foresters, intelligent men of high character, allowing them such assistance as might be required. Their duties should be to preserve the game, destroy the wolves, regulate the burning of the debris of the lumber camps and clearings, see to the due observance of forest laws, and generally to conserve woodland interests.

I think that such officers would have many important duties to perform and that their life would be full of interest and attraction.

THE ADVANTAGES AND DISADVANTAGES OF THE CANADIAN ENTOMOLOGIST.

Rev. Thomas W. Fyles, D.C.L., F.L.S., Levis, Quebec.

The youthful entomologist in England, in the forties and fifties of last century, was a privileged person—he enjoyed many advantages. Kirby and Spence were both living in the earlier half of the period mentioned. Kirby died on the 4th of July, 1850. In 1856 Spence brought out a cheap edition of the "Introduction to Entomology," and, in four years, 10,000 copies of the work were sold. This work did more than any other to popularize the study of entomology.

Those were the days of Newman, Stainton, Waterhouse, Douglas, Westwood, Morris, Wollaston, Wilkinson, and other lights. Van Voorst was publishing works on Natural History. Newman was carrying on the "Zoologist," and Stainton the "Weekly Intelligencer." There was an abundance of cheap yet valuable literature for the rising entomologist.

The comparatively small extent of the British Islands brought the number of species—say of the *Lepidoptera*—within the mental grasp of the diligent student. How different is it with us now, on this vast continent of North America! A crown-octavo volume of 723 pages is now required, for a mere list of the Lepidoptera with its index.

England in those days was a very paradise for entomologists. The plantations and hazel-copses for the preservation of the game, the open woods of—

. . . . "tall ancestral trees
O'er all the pleasant land,"

the withy-gores, the fens, the moors were all famous hunting-grounds.

It was a privilege to take part in an "outing" at some appointed place. To wander along the forest paths alive with Marbled Whites and Silver-washed Fritillaries, till the waving nets shewed the spot where the Entomologists were gathered together. The excitement of the chase, the refection in the shade of the trees, the pleasant conversation, the comparison of captures, were things to be remembered. So were the multitudinous voices of the birds that made the woodland ring. England is rich in song-birds; and linnets, goldfinches, bulfinches, yellowhammers, black-caps, white-throats, robins, blackbirds, thrushes, and others, seemed to greet the woodland visitors in one full tide of song.

I remember an effusion that I sent to the "Weekly Intelligencer," after such an outing. It ran:—

"Come to the wild woods, come away,
Now the sun is bright in the month of May,
And the mated birds, in boist'rous glee,
Fill the wide heavens with harmony;
Now the breezes shake the hyacinth bells,
And the pale anemone whitens the dells,
And young leaves whisper soothingly,
And all is joy and light and love—
For the azure heaven is smiling above,
And the green earth laughs for sympathy.
Come where the Hair-streak* flutters by
Like a living leaf; where the butterfly†
Whose snowy wings are dash'd with green,
And with rich orange tipp'd, is seen;
Where the Chequer'd Skipper,‡ as you tread,
Springs lightly from his grassy bed;
And Clouded-border Moths§ unfold
Their tender wings of speckled gold;
Where *Fuciformis* quivers round
The stems with honeysuckle bound;
And, like a fragment from the sky,
Sweet *Alexis* gambols by;
Where *Falcula*, whose hooked wings
Have eye-like spots, to the birch leaf clings;
While near it, where the catkins play,
Papilionaria larvæ stray,
Mid forms like their own safe to be
From prowling *Ichneumonidæ*,
From the busy tit that twitters near,
And other foes they have to fear.
Oh, come to the wild woods, come away,
Now the sun is bright, in the month of May!
Come, for a thousand sights shall cheer
Your eye—a thousand sounds your ear!"

In Canada the brethren of the net are too widely scattered, the claims of business are too urgent, the mosquitoes too troublesome for such gatherings to be very frequent, very numerously attended, or very thoroughly enjoyable.

But, notwithstanding, the sugar-woods, the intervales, the neglected bottom lands of this country, the orchards, where the owners are better farmers than fruit growers, are all fine hunting-grounds.

On the 16th of August I discovered an undrained hollow in which was a thick growth of dwarf willows, sedges and flags. It was richly bordered with asters, Joe Pye Weed and Golden Rod, in full bloom. The multitude of insects clustering about the flower heads was truly astonishing. The Painted Ladies were much in evidence. *Pamphila Manitoba* was there; and there was a great show of Humble-bees, wasps, ichneumons, dragon-flies, flower-flies, etc. I spent a very profitable hour amongst them.

Bombyces were scarce in the collections of former days. We have an advantage now that was undreamed of when I was a boy, viz., the electric light. Many of the gems of our collections have been taken at this light. So late as the beginning of this month (October, 1905), I was passing by a warehouse on the Louise embankment late at night, when I saw, under an arc-light, a fine specimen of *Lophodonta ferruginea*, Pack, and one of *Charadra deridens*, Gn. I had no cyanide bottle, nor chip boxes, with me;

**Thecla rubi.*
†Anthocharis cardamines.
‡Thymele alveolus.
§Venilia maculata.

but the specimens were near together; and I swept them into my hat, and clapt it quickly upon my head. They were fidgety for a while, but soon quieted down and went to sleep; and on reaching home I transferred them to the cyanide-bottle.

Speaking of the cyanide-bottle: how great an improvement its use is to the old method of killing insects. Many a man, in the days I have spoken of, fixed a sheet of cork in the crown of his hat, and a supply of pins in the lapels of his coat; nipped his captures smartly under the wings with the tips of his thumb and fore-finger; pinned them ready for setting, and then stowed them away in his hat.

My own plan was to carry a small vial of chloroform and a few pieces of twine about two inches long in my vest pocket, and a few nests of chip-boxes in a special pocket of my coat. When I had boxed a specimen I slipped in one of the pieces of twine wet with the chloroform, to send it to sleep; and when I reached home I gave it its final quietus by piercing it under the wings with a steel pen dipped in a solution of oxalic acid. I found this a good plan, and I often make use of it still.

Before the cyanide-bottle was fairly established, men tried various expedients,—bruised laurel-leaves, formic acid, etc. One entomologist advocated, in doggerel verse, a new agent:—

"An agent nothing can surpass,
Will insects instant kill,
For preservation, too, as well,
This wondrous agent let me tell,—
Five drops, or ten, of nothing but
Essential oil of cajeput."
W. H.

There are many advantages now open to the Canadian entomologist, for which he may consider himself highly favored. There is the great advantage of having so able and obliging a scientist as Dr. James Fletcher of the Department of Agriculture, to consult in his difficulties—one from whom he may feel sure of receiving a courteous reply to his enquiries, and valuable information.

Again, the privilege is open to him of membership in the Entomological Society of Ontario, either directly with the parent stem, or through one of its branches. And in this connection, I congratulate Professor Sherman and the members of the newly-formed Branch in Guelph. One of the helps they will receive in their studies will be the receipt monthly of the *Canadian Entomologist,* a publication in which Dr. Charles J. S. Bethune has built, and is still building—and long may he continue to build— a monument that will preserve his name as long as entomologists shall be found in Canada—which I trust will be till the end of time.

The annual meetings of the Society present opportunities to be highly prized. "Like as iron sharpeneth iron, so doth the countenance of a man his friend;" and we cannot attend the meetings of this Society without feeling encouraged and stimulated.

A meeting that will be remembered with special pleasure is this present gathering. The noble institution in which we are assembled, and its beautiful surroundings; the kindness of Principal Creelman and the members of his staff; the presence with us of Professor J. B. Smith; his wonderful description of the mosquito and its habits, so beautifully illustrated, will all afford us delightful reflections.

Who amongst us has not known Professor Smith by his works? It is good, now, to look upon his face, and listen to his voice, and feel the warm grasp of his hand.

I made the acquaintance of the mosquito years ago, off Anticosti. I saw the little brute alight upon my hand, and I watched it swell and change color from grey to crimson, with some amusement; but the results taught me that such pleasures could not be indulged in with impunity. Nevertheless, as I listened to Professor Smith last night, I almost longed to be wading knee-deep in those delightful swamps he showed us, and assisting those worthy fellows who were bagging the peddlers of malaria and yellow fever.

Lastly, what advantages the modern student has in the number of admirable works, upon every branch of entomology, that have appeared of late years. Among them are Harris's Insects Injurious to Vegetation, Packard's Guide, Saunders' Insects Injurious to Fruits, Smith's Insects of New Jersey, Ashmead's Proctotrypidæ, Holland's Butterfly and Moth Books, Howard's Insect Book, Edwards' and Scudder's respective works, the valuable series of Bulletins issued from Washington, Albany, and other points of observation, not omitting Ottawa.

May the Entomological Society of Ontario flourish! May its new Branch, the Guelph Branch, bourgeon, and blossom, and bring forth fruit to the benefit of the general community, and for many a day!

ORTHOPTERA AND ODONATA FROM ALGONQUIN PARK, ONT.

By E. M. Walker, B.A., M.B., Toronto.

The following list of Orthoptera and Odonata is based chiefly upon collections made by the writer during two canoe trips in Algonquin Park, and the vicinity of Dwight, a few miles to the south-west of the Park limits. The first trip was made during the second and third weeks of August, 1902, while the second occupied the latter half of the same month in 1903. To the list of Odonata are added the names of a number of species taken by Prof. John Macoun in July, 1900, and also those of many specimens, especially nymph exuviæ, collected by Mr. Paul Hahn during August, 1904.

I wish to express my thanks to Prof. J. G. Needham for his kindness in determining some of the more difficult species of Odonata.

As August is rather late for most Dragonflies, although it is the height of the season for Orthoptera, the list of the former is by no means a representative one, but will give some idea of the dragonfly fauna of the region. It probably contains less than two-thirds of the number of species native to the district, whereas the list of Orthoptera doubtless includes more than three-fourths of the total number of species to be found there.

The country traversed is an ideal one for dragonflies, abounding in lakes and streams, which vary in their course from the most placid weed-grown reaches to the swiftest rapid. The north branch of the Muskoka River, which was our chief highway in both trips, is a very characteristic stream. In some parts of its course its surface is perfectly smooth for miles at a stretch, the shore low and fringed with alders, with a background of

luxuriant balsams and spruce; in the other parts there are rocky, turbulent rapids, and the banks are much higher with a much more varied vegetation. In other places, again, the rapids are smoother and shallower, with gravelly bottoms, and there are steep sandbanks on either side. Each kind of locality has its peculiar species of dragonflies, more species apparently being found about the gentle rapids than elsewhere.

Algonquin Park, which covers an area of about 1,600 square miles just north of the Muskoka District, lies at the extreme northern limits of the Transition life zone as it passes into the Boreal zone. Many forms of plant and animal life found within its limits do not belong to the Boreal zone in a restricted sense, but on the whole the flora and fauna are of a Boreal type. In the partly cleared and cultivated country in the vicinity of Dwight, lying to the south-west of the Park limits, several species of insects belonging to the Transition and Austral zones were met with, which did not appear within the Park limits. Among these are the following Orthoptera:

Spharagemon Bolli, Scudd. A single male of average size was taken at Dwight. This locust belongs to the Austral and warmer parts of the Transition zones, and becomes smaller in the northern part of its range. It is abundant and of large size in the Austral strip along Lake Erie, but becomes smaller and scarcer at Sarnia and Toronto, north of which I have never before taken it, except a single female from Peterboro' County.

Mecostethus lineatus, Scudd. This species was found among the sedge bordering a small lake in a brulé near Dwight. It belongs to the Transition and northern parts of the Upper Austral zones, and is replaced in the Boreal by its ally, *M. gracilis*, Scudd., whose range in Ontario overlaps that of *lineatus* considerably, as it extends southward to the watershed between Lake Simcoe and Lake Ontario. *M. gracilis* was not found in the Park, but doubtless occurs there.

Orchelimum vulgare, Harr. This grasshopper was found in small numbers in the fields about Dwight, but did not appear in the Park, nor could I find it at North Bay, Lake Nipissing, in September, 1900, although the proper surroundings apart from the northern latitude were apparently often met with. This species and *Conocephalus ensiger*, Harr., are enumerated by Scudder among the Alpine Orthoptera of the White Mountains (Appalachia, VIII., No. IV., p. 19). Their range seems to stop short of the Boreal zone in Ontario and I found the same to be true in Quebec.

Scudderia furcata, Brunn. A single male was taken near Dwight. It ranges at least as far north as Lake Nipissing, but I doubt its being a truly Boreal form. It is much commoner southwards.

Except the above species, all of which were taken near Dwight, outside the Park limits, and possibly another (*Nemobius palustris*, Bl.), whose range is not yet well enough known, all the Orthoptera in the list are inhabitants of the Boreal zone. *N. palustris* has elsewhere been taken only in the peat bogs of Northern Indiana, where several northern Orthoptera occur.

Of the Odonata, the comparatively large number of Cordulinæ, despite the fact that their season was practically over, testifies to the Boreal character of the dragonfly fauna. Most of these Cordulinæ are represented by nymphal exuviæ only. But one dragonfly, *Celithemis elisa*, Hagen, taken near Dwight, did not appear within the Park limits. I have never before seen it so far north. It is fairly common in the Austral and lower part of the Transition zones in Ontario.

The absence of *Libellula* I do not regard as significant of anything but the rather late season in which most of the collecting was done, and the character of the bodies of water met with.

Orthoptera.

Acridiidæ.—

1. *Tettix granulatus* (Kirby). Common in damp places in woods.

2. *Tettix acadicus* (Scudd.). Several specimens of what seems to be this species were taken beside a lumber road through a hardwood forest, August 20, 1902.

3. *Tettix Handcocki*, Morse. A number of long-winged examples taken from a patch of wild strawberry, lichens and short grass growing on sandy soil in a bushy field, September 2, 1902.

4. *Tettigidea parvipennis* (Harr.). Immature specimens were found on low marshy parts of the river shore.

5. *Chlœaltis conspersa*, Harr. Common in the drier parts of open woods.

6. *Stenobothrus curtipennis* (Harr.). Very abundant in low places wherever long grass occurred.

7. *Mecostethus lineatus* (Scudd.). A few were found flying about the sedge bordering a small lake near Dwight, August 23, 1903.

8. *Chortophaga viridifasciata* (De Geer). Young nymphs were found on the grassy hillsides near Dwight.

9. *Camnula pellucida* (Scudd.). Common everywhere in dry, open places in the woods and in clearings

10. *Dissosteira carolina* (L.). Common about Dwight and occasionally seen in clearings in the Park.

11. *Spharagemon Bolli*, Scudd. One male from a dry, grassy hillside at Dwight, August 23, 1903.

12. *Circotettix verruculatus* (Kirby). Common in clearings in the Park and on sandy beach at Dwight.

13. *Podisma glacialis Canadensis* (Scudd.) Walk. A common and very characteristic species, found on bushes in open woods. The specimens are smaller than those taken at North Bay on September 12, 1900, and approach the race *variegata* more closely.

14. *Melanoplus Bruneri*, Scudd. This species was found in considerable numbers in two or three limited areas near Dwight. They were found on patches of short grass and strawberries on sandy soil. September 2, 1902, one male. August 10, 1903, many specimens.

This is a western form, occurring with two or three closely allied species in the Boreal zone of the Rocky Mountain region from Alberta to New Mexico.

In my List of Ontario Acridiidæ I determined it somewhat doubtfully as *Bruneri* from a single male, but in 1903 a number of specimens were taken and I have since been able to compare them with Scudder's types of *Bruneri*. In these the pronotum is slightly narrower and more elongate than in the majority of my specimens, but the distinction does not hold good throughout the series and there seem to be no other characters of sufficient importance to justify the creation of a new species for my specimens. They are considerably larger than the few in the Scudder collection except one male from New Mexico.

M. Bruneri is probably a Boreal form extending across the plains or to the north of them.

15. *Melanoplus atlanis* (Riley). Abundant in the open sandy country about Dwight, and generally common in clearings.

16. *Melanoplus islandicus*, Bl. Common in paths and openings in woods everywhere. A very characteristic sylvan species often associated with *P. glacialis canadensis*.

17. *Melanoplus fasciatus* (Walk.). A few were taken in open woods at Whisky Falls, North River, and it was occasionally met with elsewhere, but not commonly.

18. *Melanoplus femur-rubrum* (De G.). Common in open, grassy clearings and in open marshes.

19. *Melanoplus luridus* (Dodge). Abundant on dry hillsides and scrubby fields, on sandy soil near Dwight, and occasionally seen in clearings in the Park.

There seems to be no doubt that *M. collinus*, Scudd, and *luridus* are synonymous.

20. *Melanoplus bivittatus femoratus* (Burm.). Common everywhere in rank grass in low places.

Locustidæ.—

21. *Scudderia furcata*, Brunn. Dwight, August 23, 1903, one male.

22. *Scudderia pistillata*, Brunn. Common on bushes in open woods in the Park. Our most characteristically Boreal Locustid.

23. *Orchelimum vulgare*, Harr. A single male was taken and a few others heard shrilling in clumps of tall grass in fields about Dwight.

24. *Xiphidium fasciatum* (De G.). Very common in open, grassy places everywhere.

25. *Xiphidium brevipenne*, Scudd. In rank grassy places, not very common. None were found at North Bay.

26. *Ceuthophilus pallidipes*, Walk. A great deal of careful searching was done for *Ceuthophili*, but not a single individual was found during the first canoe trip. On August 20, 1903, however, a nearly full-grown male of this species was found under a rotten log at Ragged Lake. A few very young *Ceuthophili* were also observed beneath stones beside a lumber road.

Gryllidæ.—

27. *Gryllus pennsylvanicus*, Burm. This species occurred sparingly throughout the Park.

28. *Gryllus abbreviatus*, Serv. Small-sized specimens were common in the fields about Dwight. I am still doubtful about the separation of these small northern individuals from *pennsylvanicus*, but they seem to pass through every gradation into the typical large *abbreviatus* of the Austral zone.

29. *Nemobius fasciatus* (De G.). Common everywhere in open grassy places. The small black variety, *abortivus* Caudell, was often met with in the Park.

30. *Nemobius augusticollis*, Walk. This species, by an oversight, was not collected, but its shrilling, which is easily recognizable when once known, was often heard along the banks of the North River. Unless abundant, it is very difficult to find. It is a common northern species.

31. *Nemobius palustris*, Bl. On August 18, 1903, I found this little cricket in considerable numbers in a floating sphagnum bog at the mouth of a creek flowing into Ragged Lake. (See Can. Ent. XXVI., 1904, 185.) It was the only Orthopterous insect found in the bog, except a few *Melanoplus femur-rubrum* in the more solid parts.

32. *Œcanthus fasciatus*, Fitch. Common on bushes and tall herbaceous plants in open places.

ODONATA.

Zygoptera.—

Calopterygidæ.—

1. *Calopteryx maculata* (Beauv.). Common on the river, flying along the shore amid the luxuriant vegetation.

2. *Calopteryx aequabilis*, Say. In 1902 I saw four or five of this species along the river, but captured only one, a male. In 1903 nine were seen. Among Prof. Macoun's specimens there are two fresh males dated July 6th and 25th, 1900. They are probably much commoner at that season.

Agrionidæ.—

3. *Lestes congener*, Hagen. Common in open woods and marshes.

4. *Lestes uncata*, Kirby. A single male from the North River, dated August 13, 1903.

5. *Lestes forcipata*, Rambur. Two males from the North River, August 13, 14, 1903.

6. *Lestes rectangularis*, Say. Common in swamps and open woods. It was common in an open sphagnum bog at the mouth of a creek emptying into Ragged Lake. They were associated with *Ischnura verticalis* and teneral examples of *Sympetrum vicinum*.

7. *Argia putrida* (Hagen). A number of specimens were taken by Mr. Hahn from July 15th to 21st, 1903, and 1904. I have also a badly broken teneral specimen taken by Prof. Macoun, July 6, 1900.

8. *Argia violacea* (Hagen). A pair were taken at Smoke Lake, August 17, 1903.

9. *Enallagma Hageni* (Walsh). Very common in open marshes and flying over the river in the smooth parts.

10. *Enallagma ebrium* (Hagen). One male taken by Mr. Hahn.

11. *Enallagma exsulans* (Hagen). A pair from Little Joe Creek, taken *in coitu*, August 29, 1902. Another male taken by Mr. Hahn in 1903.

12. *Ischnura verticalis*, Say. Common in marshy places bordering lakes and streams.

Anisoptera.—

Æschnidæ.—

13. *Ophiogomphus rupinsulensis*, Walsh. This fine green species was quite common on the river, flying over the shallower rapids and frequently settling on the exposed pebbles.

14. *Hagenius brevistylus*, Selys. Four males, all somewhat worn, were captured along the river. Two were taken by Mr. Hahn with one sweep of the net while flying over the water, August 22, 1903. Another was taken while resting in a path in the woods close to the river, August 20, 1903. In addition to these two nymph exuviæ were found on the rocks on the shore of Oxtongue Lake, August 10, 1903.

15. *Lanthus albistylus* (Selys). This dainty little Gomphine was fairly numerous locally over rapids. They were difficult to approach and only one male was taken (August 10, 1903).

16. *Gomphus brevis*, Hagen. A worn female was captured on the river at Whisky Falls, August 20, 1903, and a few minutes afterwards a male, also worn, was taken at nearly the same spot. Two nymph skins were found on the logs of a timber slide at the upper end of Ragged Lake.

17. *Gomphus exilis*, Selys. This nymph skin was found on the timber slide at Ragged Lake. Several others were found by Mr. Hahn on a log hut at the edge of Smoke Lake.

18. *Gomphus Scudderi*, Selys. This striking species was common on certain parts of the river, usually where there was a considerable current, but where the water was fairly deep. It was not so often seen over the swift rapids. They were usually moving along slowly with swiftly vibrating wings, every now and then making a dash to another spot. They would

sometimes alight on the canoe. Only one female was taken, but quite a number of males.

19. *Gomphus plagiatus*, Selys. A nymphal skin was found on a muddy part of the river shore just below a rapid.

20. *Boyeria vinosa* (Say). This was the most abundant of all the larger dragonflies along the river, but was never seen away from the water. It was most common on the smoother parts and had the curious habit of following the canoe, sometimes hovering close to the gunwale. A few nymphal skins were found by Mr. Hahn.

21. *Æschna constricta*, Say. A male was taken on Little Joe Creek, August 29, 1902; a pair from the North River, August 14, 1903, and a few females at Dwight, August 23, 1903. Much less common than the next species.

22. *Æschna clepsydra*, Say. The commonest Æschna in this locality; plentiful in openings in the coniferous woods, frequently settling on the trunks and branches of the spruce trees and balsams. A female was taken while ovipositing. She was resting on the edge of the shore with the end of the abdomen immersed in the water among a few aquatic plants.

23. *Æschna verticalis*, Hagen. Associated with the preceding, but apparently less numerous. A number of Æschna exuviæ were found by Mr. Hahn, but it is not known to what species they belong.

Libellulidæ.—

24. *Macromia Illinoiensis*, Walsh. A nymphal skin was found by Mr. Hahn. The imagoes were occasionally seen patrolling the river, but would swoop past the canoe and disappear so quickly that it was quite useless to attempt their capture.

25. *Didymops transversa* (Say). A nymphal exuvia was found on the rocky shore of Oxtongue Lake, some yards from the water. Several others were found by Mr. Hahn along the river.

26. *Neurocordulia* (sp.). About a dozen exuviæ were found upon the side of a timber slide at the upper end of Ragged Lake, August 17, 1903. They were mostly from two to four feet from the ground, of which there was a narrow strip between the timber slide and the water. Another was found by Mr. Hahn at Canoe Lake.

Prof. Needham, to whom I sent one of the skins, says they do not belong to *N. obsoleta* (Say), the only species of *Neurocordulia* which has been bred, and may be *N. Yamaskanensis* (Pro.), which occurs in Quebec.

27. *Epicordulia princeps*, Hagen. A single nymphal exuvia was found by Mr. Hahn.

28. *Tetragoneuria semiaquea*, Burm. One male taken by Prof. Macoun, July 6, 1900. I found the exuviæ in considerable numbers on the timbers of a log hut at the lower end of Smoke Lake. The hut was built on the shore of a shallow bay connected with the main body of the lake by a rather narrow passage. The bay was full of pond-weed (*Brasenia peltata*), and other aquatic plants and was doubtless a fine breeding-ground for Odonata. Skins of *Helocordulia Uhleri* and *Gomphus exilis* were also found on the hut.

29. *Tetragoneuria cynosura* (Say). Skins of this species, according to the distinctions given by Prof. Needham, were also found.

30. *Tetragoneuria spinigera* (Selys). Two exuvia of this genus with the lateral spines of the ninth segment considerably more divergent than the others probably belong here.

31 *Helocordulia Uhleri* (Selys). Two exuviæ taken from the log hut on Smoke Lake and a number from Canoe Lake.

32. *Somatochlora elongata*, Scudd. Two males were taken, one at the marshy bay at the lower end of Smoke Lake, August 17, 1903, the other from a lumber road which runs through the woods close to the North River, August 20, 1903. Many others were seen flying over the river and in the woods, but they are almost hopeless to catch, as they fly very high.

33. *Somatochlora forcipata* (Scudd.). A male of this rare species was taken by Prof. Macoun, July 15, 1900.

34. *Cordulia Shurtleffi*, Scudd. A single nymphal skin was found by Mr. Hahn upon a boat-house on Canoe Lake, August 15, 1904.

35. *Celithemis elisa* (Hagen). A single fresh male was captured at Dwight by Mr. Hahn, August 23, 1903.

36. *Leucoshinia frigida* (Hagen). Two females, taken by Prof. Macoun at Catfish Lake, July 26, 1900.

37. *Sympetrum vicinum* (Hagen). Very common at Dwight on September 2, 1902, and in the cranberry bog at Ragged Lake. Also seen occasionally in other marshy places. Many of the specimens seen were tenerals.

38. *Sympetrum semicinctum* (Say). Four males and one female taken by Prof. Macoun, July 23 and 25, 1900. Three of these are labelled Catfish Lake. I found them quite numerous at one spot on the upper end of Ragged Lake near the timber slide (August 17, 1903). I also saw one on Little Joe Creek. They seem to be local.

39. *Sympetrum rubicundulum* (Say). Very abundant everywhere. A number were taken by Prof. Macoun in July.

40. *Sympetrum obtrusum* (Hagen). Very common everywhere. I took more examples of this species than the preceding, but in Prof. Macoun's series there are more of *rubicundulum*.

41. *Ladona Julia*, Uhler. A male was taken by Prof. Macoun, July 5, 1900.

BUTTERFLY COLLECTING IN CANADA, 1904.

By Mrs. Nicholl, Bridgend, South Wales.

I will not weary you with a long account of my last year's collection of butterflies, because the insects that I brought home do not represent, even tolerably, the Lepidoptera of British Columbia.

I hope to return there next summer and to collect in the south-west corner of the Province, and also, if possible, to explore the north-western part of Washington Territory at the head of Lake Chelan, including a part of the Cascade Range. I believe that the "dry belt" of British Columbia, sometimes known as the Rattlesnake Belt, comprising the district south of Lake Okanagan and Arrow Lake, is perhaps the extreme northern limit of many southern species—which would be met with in typical perfection south of the boundary line. Arriving at Montreal May 22nd, I went direct to Ottawa. Here I had the pleasure of making acquaintance with the well-known Canadian entomologist, Dr. Fletcher, of the Government Central Experimental Farm, whose kind advice and assistance I found invaluable. He provided me with all the maps extant of British Columbia, gave me several introductions, and further, entertained me with a delightful day's collecting in the lovely Canadian woodlands near Ottawa. The season was late and we only took eight species of butterflies on the 24th of May, although the weather was perfect. I next went westwards to Calgary, situated amid the lowest foothills of the Rockies, and Mr. Wolley Dod hospitably entertained me at his ranch, 18 miles south-west of Calgary. Here I spent two days very

agreeably, and was much interested by Mr. Wolley Dod's fine collection of local moths and butterflies. But the weather was unfavorable, and I caught very few insects. I failed to get the local prize, Chionobas (*Œneis*) Alberta, which has, of late years, become very scarce. It formerly swarmed all around Calgary. I took Ch. varuna, E. discoidalis, and a few other insects. My next halt was at Banff, where I had a fine day and secured good specimens of Brenthis Freija and B. frigga, besides one solitary Euchloe creusa which I never met with anywhere else. I also got a last ragged straggler of Thecla eryphon high up among the pines.

June 4th found me at Victoria, where I remained for two days, and had rather indifferent weather. I here took Papilio eurymedon, P. rutulus, and Basilarchia Lorquinii, besides a few less remarkable butterflies. The woods swarmed with Cyaniris pseudargiolus. I took a great number, but all much rubbed.

June 7th, I went to pay a visit at a ranch on the mainland two miles north of the boundary line and about three miles from the sea. Here, again, weather was indifferent, but I was lucky enough to take Parnassius clodius, Papilio zolicaon (the only one I ever met with), and Phyciodes pratensis var Orseis.

Taking the C.P.R. eastwards from New Westminster, I went to Sicamous, and thence by rail and steamer down the hundred-mile-long Lake Okanagan to Penticton, where I came into the "dry belt," and found glorious weather. South of the Okanagan, Arrow and Kootenay Lakes, I spent the remainder of June, and caught a great many butterflies; of which the best is Erebia Vidleri—hitherto supposed to be peculiar to Mt. Cheam, on the Fraser—appearing in August. I did not know what it was when I took it in the valley of the Upper Keremeos, about twenty miles south-west of Penticton and over one hundred miles south-east from Mt. Cheam, at an elevation of 4,000 feet, in mid-June.

Holland does not mention the species at all, and I did not appreciate my good fortune and wait for the female to appear, as I expected to find it again elsewhere. In the Upper Keremeos I also took Chrys, zeroe, Lycæna sagittigera, and one ragged specimen of Thecla spinetorum, whilst higher up Brenthis frigga and B. freija were abundant. Close to the boundary, south of the mining town of Greenwood, Colias Alexandra v. Emilia was very common, and the same grassy slopes produced numbers of the lovely L. Acmon, L. heteronea and Melitæa chalcedon. On the mountain above Greenwood I again took P. clodius—perhaps at its most eastern limit. Near Nelson I took V. California, Thecla sæpium, and other interesting butterflies. From Nelson I went up Lake Kootenay to Kaslo, where I arrived June 30th, and found good quarters in the excellent hotel of a very keen entomologist—Mr. Cockle. I remained in this district for a week. Colias interior was probably my best catch. I also got a great many Argynnis, all of three species, Monticola, Atlantis, Eurynome and var. Clio, showing considerable variation; 2 specimens of Lycæna anna, and one high mountain Lycæna, which Mr. Cockle considered to be Podarce, but I fail to see any difference between that specimen and the series which I took, later on, at Lake Louise, and which Mr. Elwes pronounces to be Aquilo.

Mr. Cockle has a good collection of local Lepidoptera, and sent home by me some rare and interesting insects for the collection at the British Natural History Museum.

On July 11th, I went to Glacier, in the Selkirks, 4,000 feet above the sea. The weather was tolerable, but there were very few butterflies about, a few Brenthis epithore and Pamphila mandan—the American name for C. Palæmon), being all that I saw in two days.

On the 14th July I met Mr. Wolley Dod at Lake Louise, where there is a beautifully situated mountain hotel (altitude 6,000 feet) two miles from Laggan. Here we spent a week, of which the first four days were dull, cold, and miserable, with very occasional gleams of sun and frequent storms of hail and sleet; then came three days of perfect weather, such as the mountaineer and butterfly hunter dreams of for years afterwards. We made the best of our luck. B. astarte, B. alberta, Ch. Beani, Chrys. Snowi, Lycæna aquilo (Orbitulus var Franklini), Colias elis, C. nastes, and others, filled our boxes to overflowing.

On the 25th, Mr. Wolley Dod returned home, and I went into camp at Hector, just at the summit of Kicking Horse Pass (5,190 feet). I spent the remainder of the summer camping in the Rockies.

I thoroughly worked the Lake O'Hara district, on the south-western side of the great mountains whose northern precipices enshrine Lake Louise and her sister lakes. Then, returning eastwards to Banff, I went three days' march (about fifty miles) south-westwards to Mt. Assiniboine, a splendid peak 11,800 feet high, just west of the Divide, and the southernmost outlier of the glacier fields of the northern Rockies. Here I spent five days, in fine weather, though the nights were frosty, and then a week's march brought me to Field, and I encamped at Emerald Lake, about eight miles north of Field, and well on the western slope of the Divide. Here we were close to the Yoho Valley, where there is a National Park reserve and splendid scenery. It was August 19th, when three days of bad weather set in, which delayed me, and killed the butterflies. For although we afterwards had five splendid days in the Yoho, and made excursions right on to the great Wahputek glacier, I caught very little. A battered B. astarte, a much-worn B. alberta, a few Colias minismi, and several fresh Grapta zephyrus were all my captures.

I greatly regret my late arrival in the Yoho, as I believe that earlier in the season I might have found different insects to those I caught on the summit and eastern side of the Divide. Prof. Macoun, the celebrated botanist, told me that during two days' plant collecting around Field he gathered no less than forty-two species of plants which do not grow east of the Kicking Horse Pass, and the same variety might probably occur among the Lepidoptera.

Around Lake Louise, Lake O'Hara, and Lake McArthur, all high Alpine lakes, surrounded by glacier mountains, I took much the same butterflies, more or less commonly. Mt. Assiniboine afforded some variety. I took Parnassus smintheus var. Behri only at Simpson's River, about twenty miles north of Assiniboine, in a steep gorge with rock faces, above tree level. B. amphirape (or myrina) swarmed on the wet ground near Lake Assiniboine. Everywhere Brenthis astarte was to be seen (though not generally to be caught) on every rocky peak over 8,000 feet, and Brenthis alberta was equally well distributed at a rather lower level. With Astarte, on the highest summits, Ch. Beani was invariably abundant, and Chrys. Snowi shared the haunts of Alberta, only it was rather less common. Ly. aquilo was to be had still lower down, rather local, but very common where it occurred. It fairly swarmed on the damp path at the head of Lake Louise, and on a warm and very steep slope above Lake O'Hara. Colias minismi was very common everywhere on grassy slopes from 5,500 feet to 6,500 feet, whilst the beautiful orange Elis was less abundant and flew at a higher level. C. nastes was very common, on all the highest grass, and varied a good deal. The specimens I took on Mt. Assiniboine were generally paler than those from the more northern mountains. Melitea anicia var Beani and a small mountain form of probably M. rubicunda, occurred on all the higher slopes of Lake

Louise and Hector district. Chionobas Chryxus was also plentiful everywhere. Ch. jutta only at Lake Louise and in Lake O'Hara valley, half way down.

On the 29th of August I left camp and started homewards. I had one day at Banff, where I got V. antiopa, just out of chrysalis, and Colias christina—very common, but considerably the worse for wear. Then I had one day at Ottawa, and half a day at Montreal, which concluded a most agreeable expedition. But the only district that I thoroughly worked, and where I got most of the insects that were to be had, is the central chain of the Rockies, on both sides of the Kicking Horse Pass.

I cannot conclude without expressing my acknowledgments to Dr. Fletcher of Ottawa, Mr. Wolley Dod of Calgary, Mr. Wheeler (C.P.R. Survey), and Mr. Cockle of Kaslo, for the great kindness and attention they showed me. And I must also make mention of James Simpson, my guide and packer, who ran my camp, took care of me, and helped me to catch butterflies. I never saw a better man with the net nor one with a quicker eye for any variation in an insect, and I can honestly recommend him to any entomologist wishing to collect in the Rockies.

Catalogue of Butterflies Taken in Canada During 1904.

1. *Parnassius clodius.* Common on the Island of Vancouver, where I was too early for it. I took it first on the Pacific coast early in June at sea level, or but little above, and at Greenwood, about 200 miles inland, at the end of June.

2. *P. smintheus.* This is the common representative of the genus throughout the Rocky Mountains. It was common at low elevations all through June, at Nelson and Greenwood, and at Kaslo in July. I took two or three specimens of the fine dark female variety *Hermodur.* In August, in a mountain gorge near Mt. Assiniboine, at a height of 7,000 feet, at least, well above tree level, I found var. *Behri* just appearing (August 13th). No females were then out, and I never met with the insect at Lake O'Hara, or in the Yoho valley later in the month.

3. *Papilio eurymedon.* Common on the Pacific coast and eastwards as far as Kaslo. In Vancouver Island it is very abundant.

4. *P. rutulus.* Common all through the west of British Columbia. Mr. Wolley Dod does not appear to have taken it at Calgary.

5. *P. glaucus* var. *turnus.* Not so common as *Rutulus*, but more widely distributed. It was very common at Greenwood, near the boundary, in June.

6. *P. zolicaon.* One specimen only, close to the Pacific coast at the boundary. It very nearly resembles *Machaon*, but Dr. Dyar gives *Machaon* as a different species, represented in America by var. *Aliaska*, taken in Alaska only.

7. *Pontia occidentalis.* Very common all through British Columbia on the western slope of the Divide right down to the coast.

8. Var. *calyce* is the high mountain form of *occidentalis*, and is much paler on the under side, and the veins yellower.

9. *P. rapæ* is an emigrant from Europe, and not a welcome one. This was the first butterfly I caught on landing at Quebec in May. It is common all through Canada to the Pacific.

10. *P. napi.* Another European emigrant, universally common but nowhere destructive.

11. *Synchloe creusa.* Of this insect I only took a solitary specimen at Banff, June 2nd. It was probably nearly over, and I saw no more of it. It is taken on the Pacific coast and crosses the Divide at Banff. Mr. Wolley Dod inclines to think that it merges into *ausonides* at Calgary. I consider my specimen from Banff to be quite distinct.

12. *S. ausonides.* Widely distributed but nowhere common. I took one or two specimens at Penticton, Greenwood, Kaslo, and Nelson, but never found it plentiful anywhere. It is common at Calgary.

13. *S. sara.* Common all through the south-western districts of British Columbia. I did not get either of its varieties. It does not occur at Calgary and probably does not cross the Divide.

14. *Eurymus (Colias) Meadii* var. *Elis.* Scattered rather sparingly over all the high mountains of the main chain of the Rockies at an elevation of 6,500 to 7,500 feet. I took the greatest number on the steep slopes of a mountain above Hector Lake. It also occurred at Lake Louise, Mt. Assiniboine and mountains above Simpson River.

15. *E. eurytheme var Keewaydin.* Of this butterfly I only took two specimens at Victoria, June 6th.

16. Var. *eriphyle* is the commonest *Colias* all through Western Canada. I took it everywhere, and without any great variation. The beautiful orange type of the species and var *Ariadne* I did not meet with. I also took two in the Fraser Canyon in May, and a fine fresh one at Banff August 30th.

17. *C. philodice* is also very common and widely distributed. I never took it at a high level, but it is the commonest butterfly at Montreal and Ottawa in September. At Ottawa (September) a fine white female variety was common.

18. *E. christina.* At Banff only, where it was flying in plenty August 30th, but in very bad order, and the females far worse than the males. It is common at Calgary.

19. *E. alexandra.* One specimen only, from Greenwood, near the boundary.

20. ——. Very plentiful in the valley from Greenwood to Midway. It also occurs through the whole of British Columbia south of Lake Okanagan. The color of the under side is much yellower than in the type (*Alexandra*), in which the under side is greenish and very pale. Dr. Rebel pronounces the specimens I sent him to be *Behri* (Edwards), but in this opinion Mr. Elwes does not agree (nor do I).

21. *E. interior.* I took it only at Kaslo, where it is not very common. Mr. Wolley Dod takes it in some numbers at Calgary, where it flies among the spruce in July, which is just where and when I took it at Kaslo.

22. *E. pelidne* var. *Minismi* (Elwes). This a very common butterfly over the whole of the higher Rockies, flying from 5,000 to about 6,000 feet. The females vary considerably, the white ones being commoner than the yellow. It flies all through August. (Dr. Rebel pronounces this insect to be not *Pelidne,* but *Skinneri* (Barnes), which he considers to be a good species.)

23. *E. nastes.* Common at very high levels on every mountain I went up in the whole chain of the Rockies. It varies considerably and I think that those from Mt. Assiniboine, the most southern point at which I found them, are paler and yellower than more northern specimens.

24. *Euptoieta Claudia.* One specimen only taken at Mt. Assiniboine in August, close to the lake, at 5,000 feet or more. It is a southern butterfly,

but a wanderer. Mr. Wolley Dod has taken two at Calgary, and there is one in the Banff museum.

25. *Argynis cybele.* Common all through the Atlantic States. Mine were taken at Ottawa, in September. Mr. Wolley Dod gets it at Calgary, but not commonly.

26. *A. atlantis.* Very common and widely distributed all through British Columbia. I took it at Kaslo, Greenwood and in the high Rockies below tree level. *Atlantis* is very like *Electa*, which Mr. Wolley Dod takes, though not commonly. I have no specimens of *Atlantis* from Calgary.

27. *A. monticola.* Widely distributed and common. I took it at every place I visited from the third week in June till the end of August. The high mountain specimens differ little from those at lower levels. It is a variable species as to color and the silvering of the spots of the under side, but the markings are the same in all that I have taken.

28. Var. *purpurascens*, which I took only near Greenwood and Nelson at low levels. It is given by Holland as a variety of *Zerene.* Dyar gives it as a variety of *Monticola*, with which its markings exactly coincide. I do not possess *Zerene.*

29. *A. coronis.* I never took this species at all on the western side of the Divide, but I believe that I got a battered individual at Banff, August 30th. Those I have were all taken by Mr. Wolley Dod near Calgary, where it is not uncommon. Very like *Halcyone.*

30. *A. nevadensis.* Widely distributed through the Rocky Mountains, but I never saw it common except at Banff, where there were many, much worn, August 30th. It ranges as high as tree level, but I never took it west of the Divide. Common at Calgary.

31. *A. nevadensis* var. *Meadii.* One, June 18th, in the Upper Keremeos, and one, much battered, at Mt. Assiniboine, August.

32. *A. eurynome.* Widely distributed, nowhere common. I took a fine dark form in the Selkirks at about 8,000 feet. I also took a paler form at Kaslo.

33. *A. eurynome* var. *Clio.* Also widely distributed and not common. My high mountain specimens are all much paler than the Kaslo insects.

34. *Brenthis myrina* is the *amphirape* of the Eastern Hemisphere. I found it in swarms at Mt. Assiniboine in August, flying over the marshy ground near the lake, which was formerly the basin of a great glacier. I also took it by Lake Louise in July. Mr. Wolley Dod takes it commonly at Calgary.

35. *Brenthis chariclea.* Very common everywhere in the Rockies among brushwood. Common at Calgary.

36. *Brenthis chariclea* var. *Boisduvalii*, is apparently undistinguishable from *Chariclea*, though Holland gives it as a separate species.

37. *B. chariclea* var. *obscurata.* I have so called a remarkably dark female taken near Lake Assiniboine, very high up.

38. *Brenthis freija.* Common in May at Calgary and Banff. Also took it in mountain bogs near Lake Okanagan in June at 5,000 feet or more.

39. *B. frigga.* Common in bogs at Banff and Calgary, also took it near Lake Okanagan in mountain bogs.

40. *B. bellona.* Common at Calgary, Ottawa, and generally west of the Divide.

41. *B. epithore.* The Pacific form of *Bellona.* Common and generally distributed. Flies at high elevations.

42. *Brenthis alberta.* Nowhere in great numbers, but widely distributed over the higher peaks of the Rockies end of July and August. All the peaks round Lake Louise and Lake O'Hara, Hector, Mt. Assiniboine, and head of Yoho valley, produced a few specimens (not always captured). I never saw it below 7,500 feet.

43. *Brenthis astarte* is another very common butterfly, if you seek it on the highest points not entirely snow-covered. It is very hard to catch, but very unmistakable to the eye. It has an even wider range than *Alberta,* for I saw it, without securing one, at Glacier Crest in the Selkirks. The males haunt the summits, the females are to be found on the highest grassy slopes, and are not very hard to stalk, when feasting on a flower.

44. *Lemonias (Melitæa) chalcedon.* I took this fine insect only at Greenwood and in the district south-west of Lake Okanagan.

45. *L. anicia.* The commonest of the family. I took it at nearly every place I visited. Penticton, Kaslo, Lake Louise and the Selkirks all produced it in plenty; but Mr. Wolley Dod finds it rare at Calgary.

46. *L. anicia* var. *Beani.* A small and dusky high mountain form of *Anicia,* not uncommon on the highest grass slopes about Lake Louise, Hector and Lake O'Hara. I never saw it under 7,000 feet.

47. *Lemonias nubigena.* Two specimens only, from Revelstoke, a very hot place, 1,400 feet.

48. *L. rubicunda.* Another Californian insect, which extends into the Rockies as far north as Hector and Lake Louise. I never took it commonly. It may be so around Lake Okanagan in July.

49. *L. palla.* Common about Lake Okanagan, Greenwood and Kaslo in June. I never took it in the Rockies, but Mr. Wolley Dod gave me a specimen from Red Deer, 100 miles north of Calgary. There the winter is remarkably mild.

50. *Phyciodes tharos.* Very common at Nelson, Kaslo and Calgary. Did not find it in the mountains.

51. *Phyciodes pratensis.* Universally common. A small mountain form occurs at Hector, at 5,000 feet.

52. *Phyciodes pratensis* var. *Orseis.* Ranked as a species by Holland. Probably the south-western form of type. I took mine on the Pacific coast.

53. *Phyciodes camillus.* Common at Greenwood and Penticton in June, and I took one at Hector, at 5,500 feet, in July.

54. *Psyciodes mylitta.* In the Okanagan country in June. I took none in the mountains or further eastwards.

55. *Polygonia satyrus.* At Victoria in June, and at Calgary in May, all hibernated specimens.

56. *Polygonia faunus.* At Victoria only in June. Mr. Wolley Dod reports it from Calgary and Banff, but not commonly.

57. *P. zephyrus.* At Field, common in August, and at Banff.

58. *P. gracilis.* At Ottawa and Montreal only. It does not appear to occur in British Columbia.

59. *Polygonia oreas* var. *silenus.* Two specimens at Banff, August 30.

60. *P. progne.* One at Calgary, 31st May, one at Ottawa in May, and several at Ottawa in September.

61. *Eugonia californica.* Two fine fresh specimens at Bonnington Falls, near Nelson, end of June.

62. *Euvanessa antiopa.* Just appearing at Banff in August. It is common all through Canada and I took worn specimens in June in the Upper Keremeos.

63. *Aglais milberti.* Very common all along the Pacific side of the Selkirks, and I took it high up, 8,000 feet, above Glacier. I never saw it in the Rockies, but it is common at Calgary.

64. *Vanessa atalanta.* One specimen only, in July, above Kaslo. I saw one other at the same place; no others. It is very rare at Calgary.

65. *Basilarchia archippus.* One specimen only at Penticton, near the river. I saw one other at the same place. It is an occasional visitor at Calgary.

66. *B. Lorquinii.* Very common all through the western slopes of the Divide and flies at Glacier. Not seen by me in the Rockies and not found at Calgary.

67. *Cercyonis charon.* Common at Penticton, Nelson, and Banff, at low levels throughout the summer.

68. *Erebia discoidalis.* Very common at Calgary and Banff in May at moderate elevations. I never saw it west of the Divide.

69. *Erebia Vidleri.* Plentiful in the open woodlands of the upper Keremeos, in mid-June at an elevation of from 3,000 to 4,000 feet. Only males had then appeared. I did not take it on similar ground at Nelson and Greenwood a week later.

70. *Erebia epipsodea.* The commonest *Erebia* from Penticton to Calgary and flies as low as 2,500 feet.

71. *Cœnonympha ampelos,* or *ochracea,* or *inornata.* Very common everywhere at moderate elevations from Victoria to Calgary. Mr. Wolley Dod cannot separate the species.

72. *Cœnonympha elko.* One specimen only, near Lake O'Hara, in August. Evidently a wanderer.

73. *Œneis Macounii.* Taken by Mr. Wolley Dod near Calgary. He took this rare butterfly in some numbers in June last, on the summits of grassy hills, about 4,000 feet.

74. *Œneis chryxus.* Very common everywhere from the warm slopes of Okanagan and Nelson right up to the high glens of the Rockies, even above tree level. It varies little. Mr. Wolley Dod has never taken it at Calgary, but it flies at Banff.

75. *Œneis varuna.* At Calgary only, where it is common in May and June. I never saw it at Banff, or in the Rockies.

76. *Œneis jutta.* Not uncommon in mountain marshes. I took mine at Lake Louise in July. It is common at Calgary.

77. *Œneis norna* var. *Beanii.* This active butterfly is common on all the high rocky summits of the Rockies. It haunts lichen-covered rocks, which it exactly resembles in color. I never found the female lower down, as was the case with the *Astarte* female.

78. *Uranotes melinus.* At Kaslo and at Bonnington Falls in June.

79. *Thecla sæpium.* At Bonnington Falls, just out, third week of June. I was too late for it at Kaslo.

79½. *Thecla augustus.* Banff, May.

80. *Thecla spinetorum.* One much worn female, upper Keremeos, June 18th.

81. *Thecla acadica.* One at Kaslo, where it is common. I was too late for it.

82. *Callicista eryphon.* Banff, in May, high up among pines.

83. *Callophrys dumetorum.* Several wretched specimens at about 5,000 feet in June, above upper Keremeos. Probably common earlier.

84. *Chrysophanus thoe.* At Ottawa along the railway banks in September, rather common, but worn. It also occurs at Calgary.

85. *Epidemia mariposa.* Very common everywhere in the Rockies, and flies up to 6,000 feet.

86. *Epidemia zeroe.* Not uncommon in the south Okanagan country, and at Greenwood. I never found it in high mountains.

87. *Epidemia helloides.* Very common everywhere in the west at low elevations.

88. *Heodes hypophleas.* Not common. I took several at Ottawa. Mr. Wolley Dod takes it sometimes near Calgary.

89. *Chalceria Snowi.* The most beautiful of the coppers. A high mountaineer, never seen below 7,000 feet. Widely distributed over the high Rockies, but seldom plentiful.

90. *Cupido heteronea.* At Greenwood and in the lower Keremeos in June. I met with it nowhere else.

91. *Cupido fulla.* I have this butterfly from Calgary only, where Mr. Wolley Dod takes it commonly. Mr. Elwes considers it to be identical with *pheres*, which it closely resembles.

92. *Cupido sæpiolus.* Very common everywhere and flies up to 6,000 feet at Hector. Very common at Calgary. Dr. Rebel calls it *L. antiacis.*

93. *Cupido pheres.* Common in the south-west of British Columbia, Penticton, Greenwood and Vancouver. Not taken at Calgary. It is very near to *C. fulla.* Dr. Rebel calls my specimens *L. lycea* (Edw.).

94. *Nomiades Couperi.* Very common on both sides of the Divide, but not high up. Very like *Antiacis.*

95. *Phædrotes sagittigera.* Not common. I only took three at Greenwood and upper Keremeos. It is taken occasionally at Calgary and Kaslo.

96. *Agriades aquilo.* A high mountaineer, locally abundant at Lake Louise, Hector and Lake O'Hara.

97. *Agriades rustica.* Very common at Calgary. I never took it at all.

98. *Agriades podarce.* One specimen only, taken July 5th, on Bear Mountain, behind Kaslo, which is a locality for *Podarce.* I was too early to get a series and have no female, which is said to be distinct. The male is exactly like *Aquilo.*

99. *Rusticus melissa.* Very common everywhere up to 6,000 feet. (*Argus.*)

100. *Rusticus acmon.* Common near Greenwood. A southern insect.

101. *Rusticus anna.* Two from Bear Lake, which is a locality for it, and one female from Penticton. A southern insect.

102. *Everes amyntula.* Common everywhere in the West, also at Calgary.

103. *Everes comyntas.* Not common. My specimens are from Penticton. It is taken at Kaslo and at Victoria.

104. *Cyaniris pseudargiolus*. Very common and variable.

105. *Amblyscirtes vialis*. Only taken by me at Greenwood, June. Reported from Vancouver and Kaslo.

106. *Pamphila palæmon*. Very common and flies as high as Glacier.

107. *Erynnis comma*. Very common and widely distributed.

108. *Polites peckius*. Only one at Nelson, June. Reported from Calgary.

109. *Anthomaster leonardus*. Only at Ottawa, in September.

110. *Thymelicus cernes*. Common at Penticton, June. Reported from Coldstream (Pacific coast) and Calgary.

111. *Thorybes pylades*. At Penticton, much worn, in June. Reported from Kaslo and Calgary.

112. *Pholisora catullus*. Common at Penticton.

113. *Thanaos juvenalis*. At Ottawa only. An eastern insect.

114. *Thanaos persius*. Very common at Greenwood, Penticton, Vancouver and Calgary.

115. *Thanaos icelus*. Common and widely distributed.

116. *Hesperia centaureæ*. One only, very high up, above Lake Louise. None reported from other places.

117. *Hesperia cæspitalis*. Common in upper Keremeos, but nearly over. Common near Victoria (May). Not common at Kaslo and Calgary.

NOTES ON THE ABOVE PAPER BY DR. JAMES FLETCHER.

The above extremely interesting paper by Mrs. Nicholl was kindly given to us for publication last summer. Unfortunately, Mrs Nicholl's absence exploring in the Rocky Mountains during the summer, my own subsequent absence from Ottawa, and the early call for the manuscript for the Report, made correspondence with Mrs. Nicholl, about some of the above named species, impossible. As it is important that the paper should be published without delay, I add a few notes concerning some of the species, with regard to which there was some doubt, thinking that as I have collected in most of the localities mentioned, these might be of use to lepidopterists.

6. *Papilio zolicaon* is a black swallow-tail with yellow markings, *machaon* on the other hand is yellow with black markings. *Oregonia*, which flies in the interior of British Columbia, is much more like the European *machaon* but is larger. It is easily separated from *zolicaon* by its larger size, broader areas of yellow, particularly on the lower side, and by the characters of the large red ocellus at anal angle, which is much more like that of *machaon* than of *zolicaon*, not being pupilled, as a rule, but with the margin running round into the lower part of the ocellus and ending in a club-shaped expansion, with or without a short spur at the extreme anal angle. The characters are best seen on the lower side.

11. *Synchloe creusa* is smaller than *S. ausonides*, is greener beneath, with the spots smaller and silvery pearly. The black discal spot on the primaries beneath is cut off square at the bottom, where it runs along the vein. In *ausonides* this spot tapers.

20. This was probably *Colias emilia* which flies in the Okanagan valley just at the time Mrs. Nicholl was there. The male is like a large *interior* but sometimes has an orange flush. The female is very much like some females of *christina*. Both sexes have beautiful red fringes. *Alexandra* has a white fringe and a silvery white spot beneath on the lower wings. In *emilia* the spot is white but is more or less conspicuously ringed with pink. *Edwardsii*, as I understand that species, is like *alexandra*, but has pink in the fringe, and some of the females are marked as in *christina* female. *Behrii* in no way resembles the species above referred to. It is a small, very dark green thing. There must have been some mistake about the specimens examined by Dr. Rebel.

22. *Eurymus pelidne*, var. *minismi*, Elwes. I cannot find that this name was ever published, although Mr. Bean always spoke of the insect Mrs. Nicholl refers to, under the name of *minismi*. *E. pelidne*, var. *Skinneri* is the same thing.

24. *E. claudia* is a prairie species. The larvæ are sometimes destructive to pansies and other violets in gardens.

26. *Argynnis atlantis*. The Rocky mountain species called *atlantis* by Mr. Elwes is claimed by Mr. Edwards to be *electa*. There is only one form in our Rocky Mountains.

Melitæa chalcedon has not so far been recorded from a Canadian locality. Possibly this may be *Macglashani*, which occurs in the Boundary country.

M. nubigena. True *nubigena* has not been recorded from Canada.

48. *M. rubicunda*, ditto.

54. *Ph. mylitta* is a small species expanding about 1 inch to 1¼ inches. All that I have seen from the Okanagan are a somewhat similar species, *Ph. Barnesii*, with a large female expanding about 1½ inches.

71. *Cœn. ampelos*. This species at least is easily recognised by the absence of ocelli and by its silky pale fawn color. It is the only *Cœnonympha* on Vancouver Island. *Inornata* is much darker in tone than *ochracea* and has much less white beneath.

72. *C. elko* is a synonym of *ampelos*.

88. *Heodes hypophleas*. The species taken by Mr. Wolley-Dod near Millarville, south of Calgary, is a magnificent insect larger and far finer than any form of *hypophleas* we have in Canada. I hope Mr. Dod will describe it.

92. *Cupido sæpiolus*. This species in no way resembles *antiacis*. The male is silvery blue above, has a double row of spots on hind wing beneath and two or three reddish spots at anal angle above. None of these characters are found in *antiacis*.

93. *Cupido pheres*. The form of this species on Vancouver Island is the variety *ardea* which has the spots beneath almost obliterated. *Lycea* is like *fulla* but is violet blue above, not the silvery blue of *pheres*.

94. *Nomiades Couperi*. The mountains form here referred to is called *lygdamus* by Canadian collectors following Mr. W. H. Edwards.

100. *Rusticus acmon*. Common across the plains.

101. *Rusticus anna*. Not uncommon on Vancouver Island and at many places in the mountains.

103. *Everes comyntas*. I never saw this from Vancouver Island. *Amyntula* is common everywhere from Manitoba to the Coast. The differences are slight, but the two species can, as a rule, be easily separated. *Comyntas* is less silvery beneath and altogether a more eastern-looking species.

INSECTS INJURIOUS TO ONTARIO CROPS IN 1905.

By James Fletcher, Dominion Entomologist, Ottawa.

In nearly all parts of Canada, weather reports have shown favourable conditions for the growth and maturity of crops, and Ontario has been no exception in this respect. Although reports have mentioned a large number of different kinds of insects which have been more or less noticeable by their attacks upon crop-plants, there have been fewer bad outbreaks of injurious insects than has been the case for many years; and the general report of the year in Ontario is that there have been no attacks of special importance and no new enemies which are likely to be the cause of serious loss in the future. Notwithstanding this, however, there are still plenty of the old and well known enemies which require the attention of the fruit grower and farmer; and this seems an appropriate time to again reiterate the warning that the most effective time to fight injurious insects which are known to have extensive powers of injury, is just when they occur in small numbers, as evidenced by slight injury. It becomes more and more apparent every year that preventive measures for warding off insect attack should become general principles of agriculture to be applied as a matter of course every year.

Now that spraying fruit trees to protect them against injury by the Codling Moth and the Black Spot fungous disease, has become such a matter of course with the leading fruit growers, there are numberless instances which might be cited in proof of the statement that orchards which are sprayed every year gradually become so free of their enemies that practically they may be said *always* to produce clean fruit, whereas in neighbouring orchards where no spraying is done, the opposite to this is the case.

Cereal Crops.

The worst enemies of grain crops have been conspicuously absent during the season of 1905. There have been no complaints at all of Hessian Fly; and, although, if looked for carefully, it was possible to find in one or two localities the orange larvæ of the Wheat Midge, there have been no reports received from farmers of their occurrence. Neither Wireworms nor White Grubs were mentioned in grain crops. The only exception to the general immunity was in the case of a locally rather severe occurrence of the Wheat Joint Worm (*Isosoma tritici*, Fitch). This was at Millbrook, Ont., where it did considerabe harm. Mr. T. D. Jarvis, of Guelph, also mentions Joint Worms as the cause of injury to both wheat and barley in western Ontario.

In Ontario there is only one annual brood of the Joint Worms, the insects passing the winter as larvæ within cells which they have hollowed out inside galls made at joints of the swollen and distorted straws, Fig. 29, These are, for the most part, so near the ground that a large proportion of the larvæ are left in the fields in the stubble. The ploughing down deeply or the burning over of stubble in autumn reduces the numbers of the larvæ which can turn to flies the following spring. That part of the stem which is attacked, generally swells and makes a distorted and bent gall; but this is not always the case, the attacked portion of the stem simply becoming thickened and hardened. These hardened portions frequently break off in threshing and are either carried through with the grain or with the small seeds. When cleaned out, they should be destroyed and not left on the ground, where the flies can hatch the following spring and fly to the fields. When the screenings are fed, these should always be crushed; but, if fed

to chickens, it should be done where the galls will be trampled under the feet of stock or otherwise destroyed. The straw from an infested crop should be either fed or burnt before the ensuing spring. A regular and short rotation of crops and the mowing down of all grasses along the borders of fields, have been found useful in controlling these enemies of the wheat grower.

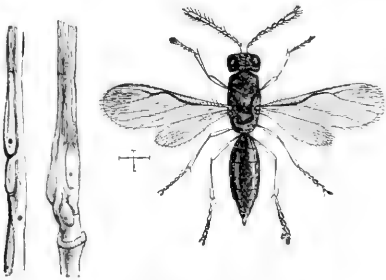

Fig. 29. Wheat-Joint Worm Fly (much enlarged), and stems showing galls.

Peas in Ontario have been an excellent crop, without any injury by insect enemies. The Pea Moth seemed almost entirely to restrict its attacks to the seeds of wild legumes such as the Purple-tufted Vetch, the Wild Tare and the Cream-coloured Vetchling. The Pea Weevil has only been reported with regard to its disappearance; and we again point out the importance of everybody insisting on having all seed pease fumigated before

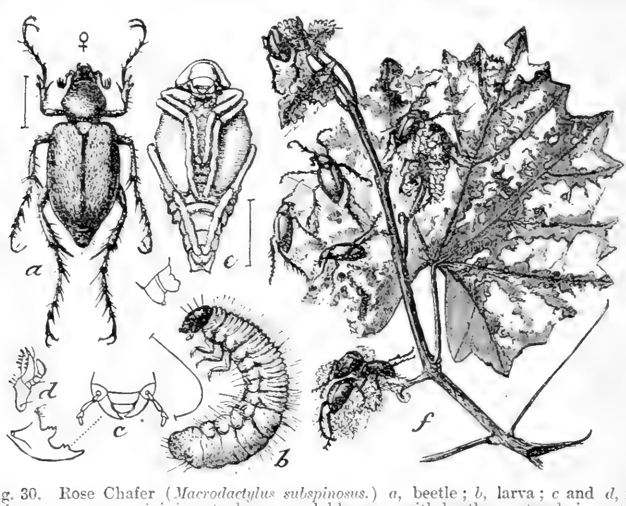

Fig. 30. Rose Chafer (*Macrodactylus subspinosus.*) *a*, beetle; *b*, larva; *c* and *d*, mouth-parts of same; *e*, pupa; *f*, injury to leaves and blossoms with beetles, natural size, at work. After Marlatt, U.S. Dept. Agriculture.)

sowing them. The reputation of our Canadian grown pease has risen again rapidly since last year, on account of their freedom from weevils; but growers may remain perfectly certain that, if they again become negligent and do not treat their seed pease, they will have to suffer for it, by the Pea Weevil increasing in numbers and in destructiveness.

Fodder Crops.

The loss in grass and fodder crops in 1905 from insect enemies was nowhere noticeable; but there were one or two interesting occurrences from the entomological point of view. The most remarkable of these was a severe, although short, attack on young corn grown in Grey county, by the Rose Chafer. *Macrodactylus subspinosus*, Fab., Fig. 30. Late in June the beetles flew in large numbers to a field of growing corn when the plants were about eight inches high and in a good vigorous condition. They appeared suddenly, covering about two thirds of a twenty acre field; and clustered, as many sometimes as twenty insects on each plant, and devoured the leaves. This swarm remained on the corn field for only three days, during which they did considerable harm, and then disappeared as suddenly as they came.

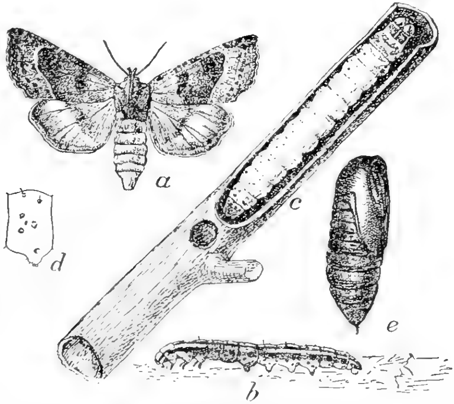

Fig. 31. Stalk-borer (*Papaipema nitela*); *a*, female moth; *b*, half-grown larva; *c*, mature larva in injured stalk; *d*, lateral view of abdominal segment of same; *e*, pupa—all somewhat enlarged. (After Chittenden, U.S. Dept. Agriculture) Full measure.

The Stalk Borer (*Papaipema nitela*, Gn.), Fig. 31, which in past years has frequently been accused of doing injury to various plants, but of which no reared specimens were to be found in collections in Canada, was this season certainly identified from specimens sent from Fargo, Ont., by Mr. G. W. Riseborough. In previous years all larvæ sent in under the name of "*Gortyna nitela*" proved to be when reared, *Papaipema cataphracta*, Grt., which is a much wider-spread species in Canada and of which the larva is very similar to that of *P. nitela*. This is a rather general feeder, like *P. cataphracta*, but has more frequently been known as the Potato Stalk Borer, although it attacks corn probably to a greater extent even than potatoes. Mr. Riseborough found the larvæ in some numbers in his corn field

and also sent specimens which had attacked potatoes and Canada Thistles. Moths were reared from these, and also some parasites. Later in the season the corn crop outgrew the injury, as there were sufficient plants left, and a good crop was reaped.

"Silver Top" in timothy and other grasses was not so much noticed as usual, although it caused some anxiety in Middlesex county early in July. The cause of this whitening of the head is the work of a very small insect belonging to the Thripidæ, probably *Phlœothrips poaphagus*, Comstock, which attacks the soft growing base of the top joint, inside the uppermost sheath. The same, or a similar injury, occurs in oats in which not the whole panicle but the lowest flowers while in the sheath are attacked and blighted, so that they turn white and never develop. The injury of the Grass Thrips is of an intermittent nature, but is always much worse in meadows which have been down to grass for many years, and particularly when the land is exhausted or of low fertility. There is no remedy which can be applied to grass lands; but a short rotation by which the land is ploughed up at short intervals and used for other crops, has been of great advantage. The presence of the Grass Thrips was noticeable in almost all localities through the province, wherever looked for, and the only reason it was not more complained of, was the abundant growth of all grass from the frequent and well timed rains.

The Clover Seed Midge (*Cecidomyia leguminicola*, Lintner), although perhaps not quite so destructive as in 1904, was still terribly abundant and its presence could be detected by the appearance of the clover fields at the end of June and early in July in all parts of the province. It was more abundant at Ottawa than it has ever been before. No better remedy has been discovered than that one which has given such good results wherever tried, of feeding off seed clover fields up to the 20th June and then leaving the second crop for seed.

The Clover-leaf Weevil (*Phytonomus punctatus*, Fab.) occurred this year for the first time at Ottawa. No injury was noticed on the clover crop, a few specimens only of the mature beetle being taken. Although loss from this insect is seldom extensive, owing to the prevalence of the parasitic fungus, ***Entomophthora sphærosperma***, Fres., which destroys the larvæ in enormous numbers. It will be well for clover growers in the district to be on guard against an outbreak next June.

The Green Clover Weevil (*Phytonomus nigrirostris*, Fab.), as is usually the case, was far more abundant and destructive than its larger and more formidable looking relative. The newly emerged perfect beetles appear in July and in autumn, and pass the winter as beetles, hidden away beneath leaves, moss, etc. The slender slug-like grubs feed upon the leaves, particularly those surrounding the forming flower heads of which they eat the stipules; they also burrow into the heads, where they destroy many of the flowers during June. When full grown, they spin pretty white lace-like cocoons inside the bracts of the clover heads. The summer brood appears early in July. When clover fields show the presence of this or the Clover leaf Weevil in large numbers, they should at once be fed off or cut. If the beetles are noticed very early in the season, it may be found desirable to plough down the clover in May and use the field for corn or for some other crop.

The Clover-seed Caterpillar (*Grapholitha interstinctana*, Clem.) was noticed in many places, the pretty little silvery moths being seen on the foliage and flying about the flowers. The injury from this insect is, as a rule, small in extent, and the same remedies will answer for it and the clover weevils.

The Red-headed Flea-beetle (*Systena frontalis*, Fab.), Fig. 32. This beetle which has a very wide range of food plants was found as a destructive pest on the second crop of clover in August, both at Ottawa and Guelph, Ont. The insect, which is a common species, was rather more abundant than usual, and it occurred doubtless at other places where it was not noticed.

Root Crops and Vegetables.

The favourable season enabled all garden and field crops of this class to develop well. Cutworms of a few kinds, as usual, did considerable harm locally; but there was no extensive outbreak such as sometimes occurs.

During the month of July almost all plants in the flower and vegetable garden were attacked at Ottawa by a smooth cutworm-like caterpillar, when young greenish in colour, but having the body divided into two equal parts above and below the spiracles, the back being dark with three pale lines along it, and the underside of the body yellowish up to a clear yellowish side stripe. These at first rather inconspicuously marked caterpillars, were largely nocturnal in habit, coming out at night and devouring nearly all kinds of vegetation. They were particularly destructive to the forming seed pods of larkspurs. After the last moult they were very much more conspicuously marked, presenting a handsome Mamestra-like appearance with three lines down the back and with each segment ornamented with large black velvety patches on the back and above the spiracles. The head honey-coloured and mottled. When full grown, these caterpillars are very vor-

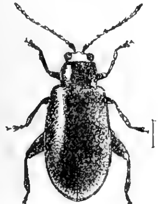

Fig. 32. Red-headed Flea-beetle (greatly enlarged) (Chittenden, U.S. Dept. Agricl.)

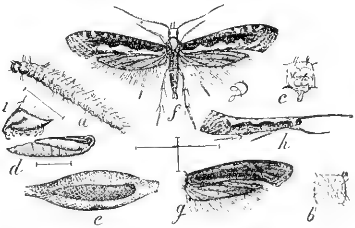

Fig. 33. The Diamond-back Moth; *a*, caterpillar; *d*, pupa; *e*, cocoon; *f*, moth—enlarged. (U.S. Dept. Agriculture.)

acious. They are about two inches in length, cylindrical in shape, like cutworms, and about a quarter of an inch in diameter. There is very much variation in their colours, some specimens being almost black, while others are of a dark olive green; but all specimens show a distinct side band and the three thread-like stripes down the back. These caterpillars were the progeny of a rare species of noctuid moth named *Barathra occidentata*, Grt., an insect which is so rare that the only specimens I had ever seen before were two reared by Mr. J. A. Guignard many years ago from larvæ which he had found destroying larkspurs in his garden; and Dr. J. B. Smith reports that it is an extremely rare insect in collections. In June, while collecting moths at Ottawa, we had found that this species was well represented among our captures, and we were pleased to secure eggs and rear the larvæ. Later, however, the caterpillars occurred in too great abundance out of doors. There is only one brood of *Barathra* in the year, the eggs being laid in June and the caterpillars feeding through July and into

August. Not only was the species found in abundance at Ottawa, but specimens were sent from Nova Scotia and were also found at Nepigon, Ont., as destructive enemies of the cabbage; it also occurred at various places between these two points, and Dr. Fyles took it at Quebec. Favourite foods in the vegetable garden were cabbage and spinach.

The Diamond-back Moth (*Plutella maculipennis*, Curtis, better known as *Plutella cruciferarum*, Zell.), Fig. 33, was abundant and destructive in many places, doing considerable harm in rape fields and on Swede turnips and cabbages. The attack, however, was of rather short duration and ended sooner in the season than is usually the case. This little insect is very much attacked by a small hymenopterous parasite which this year occurred in large numbers. The remedies for controlling the small caterpillars are rather difficult of application. They consist of kerosene emulsion, or arsenical mixtures mixed with soap washes, which must be sprayed well under the leaves by means of an angled nozzle. An important supplementary treatment is to induce a vigorous growth of the crop with light surface dressings of nitrate of soda. As a preventive measure, care must be taken to keep down all weeds and plants of the Mustard Family and to destroy in autumn all refuse plants of a crop which has been attacked.

The Turnip and Cabbage Aphis (*Aphis brassicæ*, L.) did much harm to turnip crops particularly around Guelph, but also in many other parts of the Province. There is nothing new in the way of a remedy; but it is well to emphasize the importance of feeding off or ploughing down turnip tops and remnants in cabbage fields, late in autumn, so that the over-wintering eggs may be prevented from hatching.

The Turnip Flea Beetle (*Phyllotreta vittata*, Fab.) was only once or twice mentioned in correspondence; but the favourable weather which prevailed in most parts of the province at the time the young plants were starting, gave them full opportunity to outgrow the attacks of the beetle.

The Onion Maggot and Cabbage Maggot, which for the last few years have been so excessively destructive, during the past season were hardly noticeable in many localities where in previous years they had made a clean sweep of almost everything.

The Carrot Rust-Fly (*Psila rosæ*, Fab.), on the other hand, was rather more abundant than usual and extended over a wider area than for many years past. Some early carrots at Ottawa were quite destroyed; but later sowings on the same ground produced satisfactory crops. There was no injury recorded to celery or parsnips, both of which are occasional food plants of the Carrot Rust-fly. The remedies for this insect are to take great care, when thinning out young carrots, to do this late in the day, and then spray the rows at once with a deterrent preparation, such as kerosene emulsion or a carbolic wash. The time when most injury is done, is in June and July, so that two or three sprayings, a week apart, will generally have the effect of protecting the crop. The late sowing of seed has been frequently attended with good results, and carrots should never be planted in the same spot as they were grown the previous year. Should maggots be found in stored carrots, the sand in which these roots are kept for the winter, should be treated in spring so that the puparia therein contained may not give forth their flies. This may be done either by burying it in a deep hole or by throwing it into a pond or into a barnyard where it will be trampled by stock.

Fruit Crops.

The fruit crops of the province may be said, on the whole, to have been very good in quality, although in some localities the yield was rather light.

Apples in the Ottawa valley were abundant and in sprayed orchards of first quality. In western Ontario the crop was rather poor, the shortage being due probably to lack of vigour in the trees. The very severe winter of 1903-04 worked great havoc in orchards. The trees in 1904 bore very heavily, which fact was in many cases an indication of weakness. This made a further draught on their strength, and the result was apparent in 1905. The very fact that the crop was light this season, was a benefit to the trees. Another cause for the lowering of the average of the apple crop in 1905 was the heavy wind storm which occurred in October last. Plums were a good crop and much less injured by the Curculio than last year. Peaches and pears were abundant and of high quality. Grapes were to some extent attacked by the Grape Rot; but, on the whole, vineyards which were sprayed and well looked after gave good returns. The Grape-berry moth (*Eudemis botrana*, Schiff.), Fig. 34, was prevalent in south-western Ontario, as could be seen by traces of its work in grapes which were sent to the market. This little insect, the minute caterpillars of which eat into the berries and web two or three of them together, is apparently increasing in the grape-growing districts of the province. The remedy which has been suggested by Saunders, is to gather up and burn all leaves of the vines in the autumn, so as, at the same time, to destroy the overwintering pupæ.

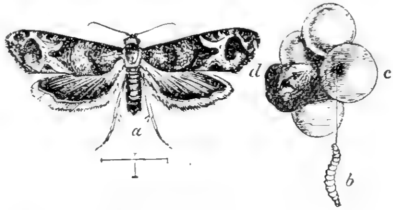

Fig. 34. Grape-berry moth; *a*, much enlarged; *b*, caterpillar; *c*, grapes; *d*, injured berry.

The San José Scale (*Aspidiotus perniciosus*, Comst.). Notwithstanding all that has been written on the subject, there is little change in the San José Scale situation. In the infested district there are still a great many fruit growers who are content to grow small, poor and almost useless crops of fruit, because they will not spray; but most of the advanced growers have now adopted the lime and sulphur wash and have grown paying crops as a consequence. That large class of fruit growers who are always on the lookout, first of all, for something new, and put off work on this score, have unnecessarily lost a large percentage of the returns which they might have had for the necessary yearly work among their fruit trees. If any new remedy is discovered which will take the place of those already in use, over-anxious people may be quite sure that it will be quickly made known and they will soon hear of it, if it proves successful. There are ample means in Canada for anyone engaged in any kind of farming to find out, free of all cost, from the Government institutions, both at Ottawa and at Guelph, what the recognized best treatment is, and they would be wise to adopt this until something better has been discovered. There is never a year passes by that some new and loudly exploited supposed improvement on recognized methods, or some new remedy, is not brought forward to be heard of for a short time and then disappear altogether. The best advice which I think can be given to those who are wise enough to acknowledge that they do not

know everything about their own work, is to watch carefully and learn from their most successful and enterprising neighbours, at the same time, keeping well posted as to the progress of the experimental work of the Government officials specially engaged to investigate these matters, and to obtain and read their reports, which are published by the Government for their benefit and all of which are distributed free to all applicants.

In this connection, it may be well to mention Prof. Close's recent improvement in the convenience of making kerosene emulsion by first mixing the kerosene with lime and then simply churning it in water, and also the later improvement on this method by Mr. F. T. Shutt, in substituting flour for lime, which gives it a much wider range of usefulness. There are many parts of Canada where lime cannot be obtained easily; but flour is a necessity everywhere, and it has been found that, for a kerosene emulsion which is to be used at once, there is nothing more convenient than to mix the kerosene and flour in the proportion of one pint of kerosene to four ounces of cheap flour, and, when this is thoroughly mixed, add one gallon of water (preferably warm) for every pint of kerosene. The whole is then vigorously churned for from two to five minutes, and the emulsion is ready for use. Even a weaker mixture will answer if the emulsion is to be used immediately: for two ounces of flour will emulsify, or more correctly hold entangled around its molecules, one quart of kerosene for a sufficient time to be applied by a spraying pump; but, on standing for a short time, the kerosene will separate from the water. Mr. Shutt has also found, however, that by scalding the flour before adding the kerosene, an excellent emulsion which will not separate for several days, can be prepared with two ounces of flour and one quart of kerosene, mixed with two gallons of water. For immediate use and particularly in gardens and over small areas, this emulsion will be of the greatest value. The above quantities for making the new emulsion give a percentage of coal oil to water equal to that contained in the ordinary Riley-Hubbard formula, which has two gallons of coal oil in every thirty gallons of wash ready for use.

These new kerosene emulsions have been very much discussed in connection with work against the San José Scale; and it is probable that, if their application were persisted in, they would finally vanquish the San José Scale; but the cost of labour and materials in these frequent applications would probably render them unpractical remedies. For this redoubtable enemy, something more drastic is necessary; and the lime and sulphur wash which has so frequently been recommended in our reports, is still the best standard remedy for that insect. The recently sent out proprietary remedies "Kil-o-Scale" and "Scalecide", notwithstanding their forbidding names, are said by Dr. J. B. Smith, of New Jersey, to have given good results. These are petroleum preparations prepared, I believe, to a large measure in accordance with Dr. Smith's advice. For the meantime, however, the lime and sulphur wash remains the standard remedy for the San José Scale, and, if regularly and carefully used, will keep trees in a healthy condition and enable them to produce paying crops of fruit.

The Woolly Aphis of the Apple (*Schizoneura lanigera*, Hausm.). See Fig. 1, page 10. An insect which has been particularly abundant and much noticed by fruit growers from the conspicuous white colonies which have been seen on apple trees and hawthorns during the past season is the Woolly Aphis of the Apple. It is many years since this insect has appeared in the vast numbers that it was noticed in 1905. The injury, however, has not as yet been very great, and, since the root inhabiting form is seldom destructive in Canada, it is to be hoped that the abundant occurrence of the past season will not be attended by serious after consequences in our or-

chards. The attacks were largely upon nursery stock, and the colonies could doubtless have been destroyed by an application of kerosene emulsion or a whale-oil soap wash. As the colonies are so dense and frequently many of them are hidden inside an open swelling caused on the bark of young trees by their punctures, spraying the above insecticides would not in all cases reach all of the insects. Where possible, a more thorough application by means of a stiff brush would probably be more satisfactory. In very bad instances, however, twigs high up in the trees may be covered with the plant-lice, and in such cases the only practical treatment would be spraying with a strong kerosene emulsion (one to six), and the liquid must be applied with as much force as possible.

The Buffalo Tree-hopper (*Ceresa bubalus*, Fab.). This little homopter is often complained of for the injury done to young apple wood by the egg-laying females, which cut crescent-shaped slits in pairs along the young branches when depositing their eggs. These slits run deeply into the wood and leave lasting scars which give an ugly gnarled appearance to the trees. Injury is seldom severe; but a remarkable instance has occurred during the past summer in Mr. J. P. Gourdanier's magnificent seventy-acre orchard at Morven, Lennox county, Ont., where nearly all the trees were severely injured. The remedy usually recommended for this insect is to spray at the time the young hoppers hatch, with kerosene emulsion. In this case, however, spraying with crude oil or a strong kerosene emulsion just before the buds burst in spring would be advisable, so as to kill the eggs. It has been found that the young do not feed to any extent upon the apple trees after hatching; but upon weeds and other coarse vegetation near the ground. All such useless vegetation, therefore, should be kept closely mowed and the ground cultivated in infested orchards.

Forest and Shade Trees.

Perhaps the most noticeable occurrences of insects upon forest trees during the past season were the reappearance of the Larch Sawfly and the remarkable increase in the numbers of the Spruce Gall-louse, *Chermes abietis*, L. This latter insect has been the cause of considerable anxiety among growers of ornamental spruces for some years. It undoubtedly renders the trees very unsightly and gives them an unhealthy appearance; but I know of no actual instance where it has killed trees. The young issue from the cone-like galls about the middle of August and crawl about on the trees, where later eggs are laid from which hatch young plant-lice that remain on the twigs until the following spring. Their presence in the young buds of the spruces causes slight swellings at the base of the leaves. Each female of the May brood lays about 300 eggs and the young from these, cluster in the swellings begun by their mothers, where they soon cause the galls which later are so conspicuous. No treatment is possible upon forest trees; but, upon hedges and ornamental specimen trees, good work has been done by spraying them at the times the young plant-lice are exposed and before they are enclosed in the galls, with a tobacco and soap wash, or with kerosene emulsion. The two seasons of the year when the young plant-lice may be reached are in the latter part of August and in May. A good soap wash may be made by soaking ten pounds of tobacco leaves in enough hot water to cover them. Then strain off the liquid and add two pounds of whale oil soap. When dissolved, dilute to forty gallons of water. Two or three applications of this spray should be made at short intervals.

The Tussock Moth has been fully treated in other parts of this report so requires no special mention here.

The Larch Case-bearer (*Coleophora laricella*, Hbn.). During the past summer the European larches on the Experimental Farm, at Ottawa, were seen to have many bleached leaves on some of their branches and upon close examination it was found that the leaves were being eaten by large numbers of the small European Elachistid, *Coleophora laricella*, Hbn. This had been recorded previously on larch trees in America; but I am not aware of its ever having been observed in Canada. The injury was not very severe, but every new importation of this nature is worthy of consideration, and it is to be hoped that this latest visitor may not be equally injurious here as it is in the German larch forests. The larval case is somewhat similar to that of the Cigar Case-bearer of the Apple, but is rather shorter and pale drab in colour. The caterpillars have a curious habit, when full grown and ready to pupate, of fastening themselves in the centre of a fascicle of leaves, where they are difficult to detect. There is only one brood in the year, the moths of which appear in June. They are very small, of a satiny ashy gray in colour, with long antennæ and very long fringes to the wings. After pairing, the females lay their tiny yellow eggs singly on the needles of the larch. These soon after hatch and the larvæ eat their way into the slender needles, of which subsequently they make a very slender case about one-eighth of an inch long, in which they pass the winter attached to the twigs of the tree. As soon as the young buds begin to swell in spring, these minute caterpillars revive and feed upon the young leaves. The presence of the caterpillars upon a tree is easily recognized by the condition of the leaves, the terminal portion of which is bleached and soon shrivels. When the caterpillar attacks a leaf it eats a hole in the side, and, as it consumes the interior portion, it protrudes its body until it can reach no further without leaving its case. The winter case soon becomes too small, when it is split down the side and the emptied skin of another leaf is inserted. The case in which the Larch Case-bearer passes the winter, is straight and slender, not curved as in the case of the Cigar Case-bearer No parasites were reared, and the young larvæ are to be found in large numbers on the trees this autumn.

ENTOMOLOGICAL RECORD, 1905.

BY JAMES FLETCHER, DOMINION ENTOMOLOGIST, OTTAWA.

Although few of the correspondents mentioned in the last Entomological Record, to all of whom it was sent, have expressed an opinion of its utility, I learn indirectly that it is highly valued by entomologists as a means of learning what is being done in the country, where species have been taken by our collectors, where these live, and what orders they are specially interested in. Most of this evidence, however, has been given gratuitously by specialists living outside of Canada.

Up to the present time the Entomological Record has been sent regularly to every active collector known to me in Canada. In future it will be sent only to those who acknowledge its receipt.

From the large number of records sent in, it is evident that some of our collectors do not understand the objects of publishing this paper. These were stated in our first issue and repeated in 1902. There is no idea of publishing year after year long lists of insects which have been taken within

their own range, but only such data as it is thought will be of value to students of geographical entomology and to those interested in life-histories, particularly the exact dates when various insects occur in the perfect state. It is hoped in this Record to publish a list of rare species or such as have not previously been noted as occurring in Canada; to give exact data as to the distribution of species together with dates when certain insects have been taken, so that localities may be visited and desirable species sought for at the time and place where they are known to have occurred; also to draw attention to works of particular value in the different departments of entomology, and to place on record anything which it is thought will encourage the study of insects in the Dominion.

A great many notes on captures have been sent in, and from these a selection has been made of such species as in the opinion of the writer or those specialists whom he has been able to consult, seemed worthy of recording. As in the past, great care has been exercised in endeavoring to arrive at correct determinations.

I have again to express great gratitude to the well-known specialists in the various orders who have so patiently identified large numbers of insects for Canadian collectors; and I am glad to know from these gentlemen that their own collections have been considerably enriched from the interesting northern and western Canadian material, much of which was unrepresented in the large collections of the United States. Particular mention in this direction must be made of Dr. J. B. Smith, of New Brunswick, N.J., who is untiring in his efforts to help all who apply to him. The same must be said of Prof. H. F. Wickham, of Iowa City, Iowa, Mr. W. D. Kearfott, of Montclair, N.J., and Dr. Skinner, of Philadelphia. Dr. L. O. Howard, U. S. Entomologist, and his expert associates, in the Bureau of Entomology, at Washington, have, as heretofore, given invaluable help in almost all orders of insects, to the many who have constantly asked for it.

The season of 1905 has been irregular, correspondents differing considerably in their opinion of it. On the whole, however, in most places it probably was a rather unproductive year. The cool nights and damp weather in many districts through the collecting season were very discouraging. Notwithstanding this, many good species were taken, and, as is always the case, energetic workers added many desirable species to their collections.

Among the important expeditions in our country, mention may be made of another extensive trip by Mrs. Nicholl, of Bridgend, South Wales, who again spent the summer in our Rocky Mountains and the mountains of Washington State, where she made large collections of butterflies and other insects. Another expedition of which up to the present time no report has been received, was made by Mr. J. Chester Bradley, of Ithaca, N.Y., together with a large party of naturalists, into the Selkirks, the mountains around Revelstoke and down the Columbia River. Mr. J. Keele, of the Geological Survey, Ottawa, brought back a small but most interesting collection of insects from the Yukon Territory. Among these were *Erebia Magdalena, Eurymus Boothii* and *Cœnonympha kodiak*—all insects of great rarity. Mr. W. J. Wilson, also of the Geological Survey, likewise made a collection of insects in the Hudson Bay country.

The collections of insects of our own Society at London, and those of the two Government institutions, viz., at the Central Experimental Farm, Ottawa, and at the Agricultural College, Guelph, have been materially increased during the past year; and it might be well for Canadian collectors to remember that there are a great many insects not represented in the cabinets of all these three institutions, and that specimens will always be acceptable.

Efforts are made to help applicants whenever possible with identifications, and the more complete these collections are, naturally of more use will they be to the whole country. We are glad to welcome Prof. Franklin Sherman, jr., at the Ontario Agricultural College at Guelph, and as his duties are more restricted than were those of his highly esteemed predecessor, Prof. W. Lochhead, we look for a rapid increase in the college collections. We would remind all our readers that as these Guelph collections, with the exception of Lepidoptera, are practically new ones, many species are entirely unrepresented, and, if properly labelled as to localities and dates, specimens in all orders taken in Ontario will be very acceptable to Prof. Sherman. Even unnamed material will be thankfully received.

Prof. Lochhead, who has done such good work at Guelph for many years, has severed his connection with the Agricultural College and has been appointed Biologist at the Macdonald College of Agriculture, Ste. Anne de Bellevue, Que. Doubtless he will soon make collections of insects for the Province of Quebec and will form at his College another centre for the accumulation and dissemination of knowledge concerning Canadian insects.

Literature.

Biographical notes on entomology appear regularly in all the entomological journals and scientific magazines, such as the *Canadian Entomologist*, the *Ottawa Naturalist*, *Entomological News*, *Journal of the New York Entomological Society*, *Le Naturaliste Canadien*, and *Psyche*. These publications are indispensable to the working entomologist. Among the articles upon North American moths, Mr. Wolley Dod's series of papers in the *Canadian Entomologist*, giving critical notes on the Noctuids he has taken at Millarville and Calgary are of the greatest value to students of Western Canadian insects.

Among the books which have appeared during 1905, some are of special importance to Canadian students.

Aldrich, J. M. A Catalogue of North American Diptera. Smithsonian Misc. Coll. XLVI., No. 1,444, 1905, pp. 680.—The latest catalogue of North American Diptera which has had to serve students until the present time was that by Baron Osten Sacken, published by the Smithsonian Institution in 1878. Many who would have taken up the study of flies have been prevented from doing so, for the lack of some systematic list by which they could arrange their collections. Prof. Aldrich has produced a most valuable contribution to entomology and there are few books which have appeared on this branch of science which have been so gladly welcomed as his catalogue. The work is done admirably and the greatest care has evidently been taken in searching literature and in verifying references. The references to Canadian publications are very complete and with this catalogue and the four Entomological Records which have appeared in our last four annual reports a check list of Canadian Diptera might now easily be made out. There has been an enormous increase in our knowledge of American flies during the last 27 years. In the present catalogue no less than 8,300 species are mentioned. The printing and general get-up of this work are as nearly perfect as can be. We congratulate the author in having finished so well this great work which has taken him seven years of patient labor.

Cook, Mel. T. The Insect Galls of Indiana (20th Annual Report Dept. Geology and Nat. Resources of Indiana, 1904, pp. 801 to 871).—We have received from Prof. Blatchley a separate copy of Mr. Cook's interesting and well illustrated pamphlet, which makes a fitting companion for Mr. Beutenmuller's bulletin on insect galls, noticed in our last issue. This will be found

a useful help to those who are now taking up this attractive subject. Biographical references under the different species are a noticeable feature.

KELLOGG, Vernon L. American Insects. Henry Holt & Co., New York. Pages 674; 13 colored plates; figs. 812 in text.—Prof. Kellogg gives us in this work a useful addition to the books on general entomology which will be appreciated by beginners and will be found interesting to all who consult it. It is more popular and more up to date in many respects than the two standard works of a similar nature, Comstock's "Manual for the Study of Insects" and Packard's "Text-book of Entomology." The author states in the preface that "the book is written in the endeavor to foster an interest in insect biology on the part of students of natural history, of nature observers and of general readers, and does, as it professes, provide in a single volume a general systematic account of the principal American insects. Comstock's classification, which is now generally adopted by American teachers, is followed and synoptic tables are given which will be found very useful to students. The whole work shows evidence of the writer's original investigations, but naturally the specialist is more apparent in certain places than in others.

The physiology of insects, their relations to the development of plants and as carriers of disease, are treated of at greater length than is usual in such works, and form valuable contributions to the literature of these subjects. The printing, paper and general get-up of the book are excellent. The colored plates are good and will be found a great attraction to many who wish for such a work as a present for boys and girls. A few of the text figures are poor, and there are a few instances of errors as to the names of species represented. These, however, are minor faults which can be corrected by an "errata" slip or in a future edition.

HAMPSON, Sir George F. (Bart.), Catalogue of the Lepidoptera Phalænæ in the British Museum. Vol V. Noctuidæ, 1905, pp. 634, plates 78 to 95.—This volume is a continuation of Sir George Hampson's monographs of the moths of the world, and gives the classification of the subfamily Hadeninæ as he understands it. "The subfamily is characterized by its trifid neuration of the hind wing combined with the hairy clothing of the eyes and forms an extremely natural and well-marked group of species." The generic names used will be found unfamiliar to American students. The old genus *Mamestra* is now included in *Polia*. Many species recognized in our lists are included as synonyms of other species. Possibly, however, larger series of specimens would enable the eminent author to change his judgment on some of these. The specific limits of many insects can only be decided after careful breeding from the egg, a class of work which is now receiving great attention in this country, and of which much is still to be done for many North American species. Some of the Canadian localities given are very vague and give little information as to distribution. The figures in the plates are for the most part excellent and about 160 species are shown which have already been or are likely to be found in the Dominion. It is noticeable what good work has been done by Mr. F H. Wolley-Dod in supplying Sir George Hampson with specimens.

OSBORN, Herbert. Jassidæ of New York State. (20th Report of the State Entomologist of New York, pp. 498-545. This comprehensive list of the Jassidæ of New York is of special interest to hemipterists in Eastern Canada, as all the 175 specimens mentioned may be expected to occur with us. Prof. Osborn has for many years made a special study of the Jassidæ, so is well fitted to prepare this list. It is printed on good paper and in the admirable manner characteristic of Dr. Felt's reports. It contains copious bibliographical references and is carefully indexed in the general index to the Entomologist's report.

SKINNER, Henry (M.D.). Synonymic Catalogue of North American Rhopalocera, Supplement No. 1.—A supplement to Dr. Skinner's Catalogue of 1898, giving references to the literature of the subject up to the end of 1904. This will be found a most useful help to students of North American diurnals and shows that a great deal of attention has recently been given to these attractive insects. No working entomologist can do without this supplement. Dr. Skinner's well recognized knowledge of North American diurnals makes his critical notes a valuable feature of the pamphlet, which is printed in the same neat and convenient style as the original catalogue. The genera, we are glad to see, appear under the same names as before, which seems preferable for the present at any rate.

SMITH, J. B. (Sc.D.). Reports upon the Mosquitoes occurring within the State of New Jersey, their habits, life history, etc. Trenton, N.J., 1904, pp. 482.—Copiously illustrated with numerous figures and plates. No index. Many books and pamphlets have recently appeared upon mosquitoes and the mosquito question, but none, we think, so complete or of such general utility as this extensive report. The work has been done thoroughly, as all of Prof. Smith's work is, and his results are presented in a readable and intelligible manner, which must make the report very satisfactory to the people of the State of New Jersey, who provided the necessary funds for the large amount of work which was necessary in carrying out the experiments in draining large marshes, making of surveys, etc., as well as for the scientific biological work carried on in the laboratory. The report is well arranged. Part I. treats of mosquito characteristics and habits; Part II., checks and remedies; Part III., classification and descriptions; Part IV., local problems and surveys. Parts I. and III. will be of greatest interest to the systematic entomologist, no less than 37 species of New Jersey mosquitoes are described and fully illustrated. The whole work shows the capability of the author in carrying to a successful issue a work of great magnitude and also one demanding great scientific knowledge.

VAN DUZEE, E. P. List of Hemiptera taken in the Adirondack Mountains. (20th Report of the State Entomologist of New York, pp. 546-556.) Although less complete than Prof. Osborn's list of Jassidæ of New York, the present paper will be found to be of great value to Canadian students on account of the similarity of the fauna treated of and that of vast and varying areas in Canada. It is a most welcome addition to the literature of an order which requires many more students than so far have given their attention to it. Mr. Wm. Metcalfe of Ottawa has shown what good work may be done even in a restricted locality by an energetic collector.

WRIGHT, W. G., The Butterflies of the West Coast of the United States. (The Wittaker & Ray Company, San Francisco, pp. 257, 31 plates, color photography (940 figures).—This handsome work, which has just come to hand, is uniform in size, style, paper and print with Dr. Holland's Butterfly Book, and the plates are equally beautiful in execution and are superior in the important feature that many more undersides are shown, particularly among the Argynnidæ and Lycænidæ, where this is of so much importance. Mr. Wright's name is so well known as a collaborator of Mr. W. H. Edwards that his work will be read with great interest by all the older students, although perhaps younger men will not altogether approve of the generic classification adopted. This, however, is, as the author points out, not a matter of very much moment so long as the specific names remain constant. He naively says: "Students should bear in mind that the species is the foundation. Genus and family names are more or less arbitrary. . . . When looking up a butterfly in the index, look for the specific name rather than

the genus or family name, because these latter names are found in all sorts of queer places, according to the fancy of the man who writes the list."

The first chapter, "General Features of Butterfly Life," consists of short essays giving the author's views on many subjects which will be read with interest, but with some of which lepidopterists will not agree. They are valuable as being founded on the author's personal experience and observation of the species treated, mostly in California. A complete list of the butterflies of the United States gives the names as classified by Mr. W. H. Edwards with the date of the original description. The names of the Pacific coast species are in full-faced type and the descriptions are numbered in the body of the book the same as the figure on the plates, which makes them very easy of reference. The points of difference between allied species are original, and coming from one with such long experience with the species mentioned will be very useful. This work will be of great value to our collectors in British Columbia, where many of the California species occur; but *Thecla blenina* and *T. spinetorum*, two species which probably they will first look for, will be a disappointment. The former, although referred to in the Index, is neither figured nor described, and *spinetorum* as figured is neither the insect which occurs in collections under that name, nor the closely allied *T. Johnsonii*, of Skinner. Our Vancouver Island friends will read with much amusement the description of their climate given under *Chionobas gigas*. Mr. Wright visited Mount Finlayson on July 3, 1891, for eggs of *C. gigas*. He says: "The males stay about the bare rock-knobs, flirting and playing during the few sunny hours that shine upon the rocks in that cloudy, raw climate." *C. gigas* and *nevadensis* are treated as different species, the latter being considered as more nearly related to *californica*.

The following is a list of the full names and addresses of the collectors referred to in the "Notes of Captures" for 1905:—

Anderson, E. M., Victoria, B.C.
Baldwin, J. W., Ottawa.
Bethune, Rev. C. J. S., London, Ont.
Bryant, Theodore, Wellington, B.C.
Bush. A. H., Vancouver, B.C.
Chagnon, Gus., Montreal.
Cockle, J. W., Kalso, B.C.
Criddle, Norman, Aweme, Man.
Dod, F. H. Wolley-, Millarville, Alta.
Draper, R., Vancouver, B.C.
Evans, J. D., Trenton, Ont.
Fletcher, Dr. James, Ottawa.
Fyles, Rev. T. W., Levis, Que.
Gibbon, Hugh, Miniota, Man.
Gibson, Arthur, Ottawa.
Grant, C. E., Orillia, Ont.
Hanham, A. W., Victoria, B.C.
Harrington, W. H., Ottawa.
Harvey, R. V., Vancouver, B.C.
Heath, E. F., Cartwright, Man.
Hudson, A. F., Millarville, Alta.
Jones, W. A. Dashwood, New Westminster, B.C.
Keen, Rev. J. H., Metlakatlah, B.C.
Keele, Jos., Ottawa.
Lyman, H. H., Montreal.
Marmont, L. E., Rounthwaite, Man.
Metcalfe, W., Ottawa.
Moore, W. H., Scotch Lake, N.B.
Perrin, Jos., McNab's Island, Halifax, N.S.
Sanson, N. B., Banff, Alta.
Taylor, Rev. G. W., Wellington, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., Toronto.
Willing, T. N., Regina, N.W.T.
Wilson, W. J., Ottawa.
Young, C. H., Hurdman's Bridge, Ont.

NOTES OF CAPTURES.

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U. S. N. M. Bull. No. 52.)

RHOPALOCERA.

(Dyar's number).

21. *Papilio brevicauda*, Saunders. Larva found at the North-west River Post of the Hudson Bay Co., on Lake Melville, Ungava, (Lyman).

37. *Pontia protodice*, Bdv. & Lec. Second specimen taken at Ottawa, September 27, (Gibson).

41. *Nathalis iole*, Bdv. Perfect female taken Sept. 29 at Rounthwaite, Man., by Mrs. L. E. Marmont. A specimen of this insect was also taken at Cartwright, about 50 miles S. E. of Rounthwaite by Mr. Heath, about 20 years ago.

64. *Eurymus Boothii*, Curtis. Lansing River, Yukon Territory, June 24, Leduc River, Y. T., July 4, (Keele). Two fine males.

65. *Eurymus eurytheme*, Bdv., b. *eriphyle*, Edw. Millarville, Alta. Nov. 17; female quite fresh and very small, evidently of a third brood; a most exceptional record, (Dod).

74. *Eurymus palæno*, L. Leduc River, Y. T., July 4; Stewart River, above Boswell, Y. T., 2 males; Fraser Falls, Y. T., (Keele).

92. *Euptoieta claudia*, Cram. Baltimore, Ont. Larvæ in dozens destroying pansies, July 11, (T. M. Wood).

98. *Argynnis leto*, Behr. McLeod, Alta. July 3, 1904, (Willing).

119. *Argynnis Edwardsii*, Reakirt. Alameda, N. W. T., June 19, 1900, (Fletcher).

Phyciodes Hanhami, Fletcher. Rounthwaite, Man., July 7, Marmont.

194. *Phyciodes Barnesi*, Skinner. Okanagan valley, 1895, (C. deB. Green); Mr. E. M. Anderson, of Victoria, B. C., has shown me some specimens so named by Dr. Dyar; and, having examined into the matter, I have no doubt that what in the past I have been naming for correspondents as *P. mylitta*, Edw. is *Barnesi*, Skin., which was described by Dr. Skinner for this similar but much larger species. I have specimens of true *mylitta* which were taken at Agassiz and Mission in the Fraser valley, B. C., but had considered them as merely dwarfs of the form which has since been described as *Barnesi*. The males of the two species are much alike. Both are figured in Holland's Butterfly Book.

209. *Polygonia faunus*, Edw. Scotch Lake, N. B., (Moore). This fine Grapta was remarkably abundant all through Canada this season. As a rule, it is one of the rarest of the genus, notwithstanding its wide range.

216. *Eugonia californica*, Bdv. Rounthwaite, August 30, (Marmont).

270. *Erebia disa*, Thun., a. *mancinus*, D. & H. Lansing River, Y. T., June 24, (Keele).

275. *Erebia magdalena*, Strk. On mountain 12 miles up Hell River, Y. T., August 2, (Keele). A very rare insect.

282. *Cœnonympha kodiak*, Edw. Lansing River, Y. T., June 24, Leduc River, Y. T., July 4, (Keele); Atlin, B. C., (sent by T. Bryant).

286. *Enodia portlandia*, Fab. MacNab's Island, Halifax, N. S., (Perrin); Cartwright, Man., July 16 & 22, first time there. (Heath).

292. *Œneis jutta*, Hbn. North Fork, Stewart River, Y. T., June 22; Lansing River, Y. T., June 24; Leduc River, Y. T., July 4, (Keele).

Thecla Johnsoni, Skinner. Vancouver, B.C., end of May, (Draper); Stanley Park, Vancouver, June 9, 6 sp., (Harvey).

472. *Ancyloxypha numitor*, Fab. Orillia, Ont., Plentiful, never taken here before, (Grant).

490. *Erynnis pawnee*, Dodge. Rounthwaite, August 10, (Marmont).

504. *Anthomaster leonardus*, Harr. Ottawa, Sept. 1904, (Mrs. Nicholl); Britannia, Ottawa, August 23, 1904, (Baldwin). This has been very rare at Ottawa up to the present time; not taken for 25 years.

555. *Limochroes bimacula*, G. & R. London, Ont., (Bethune).

HETEROCERA.

657. *Lepisesia flavofasciata*, Wlk., a. *ulalume*, Strk. Evidently remarkably abundant this year at Vancouver, where many specimens were taken by Bush, Draper, Harvey and Jones. Mr. Cockle also caught the species at Kaslo and secured eggs for rearing.

659. *Lepisesia clarkiæ*, Bdv. Victoria, B. C., May 17, 25, 27, (Anderson).

701. *Sphinx drupiferarum*, S. & A. Kaslo, June 30, (Cockle); bred from larvæ which were abundant in orchards last year, Vernon, B. C., (Venables).

705. *Sphinx Vancouverensis*, Hy. Ed. Wellington, B. C., May 30, (Taylor).

836. *Utetheisa bella*, L. Ottawa, Sept. 25, (Fletcher). The second specimen seen at Ottawa, the other one being taken Sept. 20, 1877.

861. *Phragmatobia assimilans*, Wlk., a. *franconica*, Slosson. Ottawa, June 3, 1899, (Gibson); Meach Lake, Que., May 16 & 17, (Young).

875. *Apantesis virguncula*, Kirby. Ottawa, July 6, (Baldwin). A rare species at Ottawa.

880. *Apantesis anna*, Grt., a. *persephone*, Grt. Trenton, June 17, (Evans).

880. *Apantesis nevadensis*, G. & R. a. *incorrupta*, Hy. Edw. Fine specimens reared at Ottawa by Mr. Gibson from larvæ collected by Mr. Marmont, at Rounthwaite, Man.

891. *Apantesis celia*, Saunders. Ottawa, pupa May 9, imago June 7, (Baldwin).

895. *Apantesis vittata, Fab.* Ottawa, pupa May 1, imago May 26, (Baldwin).

895. *Apantesis vittata*, Fab., b. *phalerata*, Harr. Trenton, June 20, (Evans). I doubt very much that this is a variety of *vittata*.

982. *Apatela leporina*, L., var. *mœsta*, Dyar. Kaslo,, June 1 at sugar, (Cockle).

994. *Apatela furcifera*, Gn. *Aweme*, Man., June 6, 29, common at sugar, (Criddle).

1,000. *Apatela quadrata*, Grote. Miniota, Man., June 28, 1904, (Gibbon).

1,004. *Apatela superans*, Gn. Aweme, June 12, one specimen, first time taken here, (Criddle).

1,015. *Apatela mansueta*, Sm. Kaslo, one specimen at sugar, July 1, (Cockle).

1,075. *Baileya Doubledayi*, Gn. Hull, Que., June 3, (Gibson).

1,176. *Hadena didonea*, Sm. Ottawa, bred from larvæ boring in root shoots of *Phalaris arundinacea*, June 26, (Fletcher).

1212. *Hadena passer,* Sm. Regina, N.W.T., July 15, (Fletcher).
Hadena exhausta, Sm. Cartwright, (Heath).
1,221. *Hadena apamiformis,* Gn. Ottawa, June 28, (Gibson).
1,247. *Hadena cinefacta,* Grt. Regina, June 11, 30; July 3, 14, (Willing); Victoria, May 12, (Anderson).
1,273. *Polia contadina,* Sm. Victoria, Sept. 12, (Anderson).
1,281. *Hyppa brunneicrista,* Sm. Victoria, June 6, first one taken for 4 or 5 years, (Anderson).
1,302. *Laphygma frugiperda,* S. and A. Cartwright, Sept. 29, always scarce, (Heath). Aweme, Sept. 16, (Criddle).
1,312. *Homohadena badistriga,* Grt., var. *fifia,* Dyar. Yorkton, N.W.T., July 28, (Willing); Aweme, July 10, Aug. 3 and 12, (Criddle).
1,333. *Oncocnemis Saundersiana,* Grt. Aweme, Sept. 9, at light, (Criddle). Very rare in collections.
1,344. *Oncocnemis iricolor,* Sm. Aweme, Sept. 1, at light, (Criddle). A very rare species.
1,358. *Oncocnemis cibalis,* Grt. Millarville, Alta., Aug. 27, at light, not seen for years, (Hudson).
1,354. *Oncocnemis viriditincta,* Sm. Aweme, Aug. 22 and 31, at light, (Criddle).
1,370. *Adita chionanthi,* S. and A. Cartwright, one specimen, Aug. 19, first specimen appeared here about five years ago, (Heath).
Rhynchagrotis scopeops, Dyar. Kaslo, Aug. 26, at sugar, (Cockle).
Aplectoides discolor, Sm. (Jl. N. Y. Ent. Soc., Dec., 1905.) Mouth of Skeena River, June 29. Inverness, B.C., July 16, (Keen).
1,392. *Rhynchagrotis minimalis,* Grt. Kaslo, July 20-29, at sugar, (Cockle).
1,426. *Semiophora elimata,* Gn. Kaslo, Aug. 17, (Cockle); Meach Lake, Que., May 8, (Young).
1,427. *Semiophora opacifrons,* Grt. Meach Lake, Que., Aug. 7, (Young).
1,450. *Setagrotis infimatis,* Grt. Kaslo, Aug. 7, one specimen with a pink suffusion on upper side of primaries, Aug. 11, (Cockle).
1,453. *Agrotis aurulenta,* Sm. Aweme, June 16, 1904, (Criddle). A new locality for the species.
Noctua acarnea, Sm. (Jl. N. Y. Ent. Soc., Dec., 1905.) Banff, Alta., July 11, 1902, (Sanson).
1,498. *Noctua pyrophiloides,* Harvey. Kaslo, Aug. 3 and 20, at light, (Cockle).
1,500. *Noctua havilæ,* Grt. Cardston, Alta., June 21, 1902, (Fletcher).
1,506. *Noctua substrigata,* Sm. Rounthwaite, July 20, (Marmont).
Feltia obliqua, Sm. Millarville, May 25, at light, (Dod).
1,588. *Paragrotis brocha,* Morr. Vernon, Aug., (Venables).
1,590. *Paragrotis cogitans,* Sm. Millarville, Aug. 10, at light. One male only previously taken, (Hudson).
1,623. *Paragrotis detersa,* Wlk. Larva found at Youghall, N.B., on saltwort, *Salsola kali.* Very much like that of *Paragrotis scandens,* Riley. Moth emerged at Ottawa, Sept. 6, (Fletcher).
1,660. *Paragrotis incallida,* Sm. Millarville, Aug. 27, (Hudson); July 21, very rare of recent years, (Dod).
1,693. *Paragrotis mollis,* Wlk. Millarville, at light, July 30, a great rarity, (Hudson).
Paragrotis nesilens, Sm. Cartwright, July 3, (Heath); Aweme, July 10, (Criddle); Millarville, July 17, Aug. 25, at light, (Hudson).

Paragrotis maimes, Sm. Cartwright, one at sugar, Sept. 4, always a rarity, (Heath); Millarville, Aug. 12 and 27, (Hudson). This is the species previously known in Canada as *Ridingsiana*, Grt., which, however, is a southern species.

1,731. *Paragrotis acutifrons*, Sm. Cartwright, at sugar, a single specimen, (Heath).

1,732. *Paragrotis nordica*, Sm. Millarville, at light, July 28, (Hudson).

1,881. *Barathra occidentata*, Grt. Abundant from middle of June to 1st of July at Ottawa, (Young, Gibson, Baldwin, Fletcher). Specimens also sent from Nova Scotia, (Dr. C. A. Hamilton), Quebec, (Fyles), and also found at Nepigon.

1,885. *Morrisonia sectilis*, Gn., a. *vomerina*, Grt. Toronto, May 9, 1898, (Gibson); Aweme, May 16, (Criddle).

1,910. *Scotogramma uniformis*, Sm. Kaslo, at light, Aug. 8, (Cockle).

1,953. *Heliophila unipuncta*, Haw. Wellington, B.C., March 2, (Bryant).

2,026. *Graphiphora peredia*, Grt. Cartwright, at sugar, Aug. 8, several subsequently, (Heath).

2,096. *Xylina amanda*, Sm. Cartwright, at sugar, Aug. 31, (Heath).

Xylina ancilla, Sm. Cartwright, at sugar, Aug. 31, Sept. 3, (Heath).

2,142. *Rancora strigata*, Sm. Vernon, Ap. 5, (Venables).

2,175. *Papaipema Harrisii*, Grt. Bred from *Heracleum lanatum* on the Restigouche River, N.B., (Lyman); Cartwright, one specimen, (Heath).

2,179. *Papaipema nitela*, Gn. Fargo, Ont. Although frequently recorded from Canada as a pest on potatoes and corn, these are the first specimens I have actually seen. Most of the previous records referred to *P. cataphracta*. Larvæ buried at Ottawa, Aug. 2, and moths appeared Sept. 6. (Fletcher.)

Papaipema thalictri, Lyman, var. *perobsoleta*, Lyman. Bred from roots of *Thalictrum cornuti* at Montreal West, (Lyman).

2,180. *Papaipema nelita*, Strk. Cartwright, one at light, (Heath).

2,184. *Papaipema frigida*, Sm. Cartwright, at light, Aug. 8. This is a rarity and is somewhat like a large *nelita*, (Heath.)

2,205. *Conservula anodonta*, Gn. Meach Lake, Que., July 12, (Young).

2,288. *Nycterophæta luna*, Morr. Rounthwaite, May 25, 1901, (Marmont); Millarville, July 6, asleep on thistle head in sunshine, open prairie near Red Deer River, 50 miles north-east of Gleichen, (Dod). Mr. Marmont's record was sent in in 1901 but was accidentally overlooked.

Melicleptria sexata, Sm. Aweme, July 21, (Criddle).

2,473. *Polychrysia formosa*, Grt. Meach Lake, Que., Aug. 15, (Young).

2,494. *Autographa rubidus*, Ottol. Meach Lake, Que., June 5, (Young).

2,496. *Autographa brassicæ*, Riley. Kaslo, common, (Cockle); Vancouver, June 14, (Anderson); Ottawa, Aug. 16, (Gibson); Rounthwaite, common, Marmont).

2,551. *Marasmalus inficita*, Wlk. Orillia, at light, (Grant); Montreal, July 1, (Chagnon).

2,555. *Alabama argillacea*, Hbn. Cartwright, Sept. 1, (Heath); Levis, Que., (Fyles). The Cotton Moth was abundant in many places in eastern Canada for a few days in the beginning of Sept., but not in such numbers as it sometimes appears.

2,623. *Prothymia rhodarialis*, Wlk. Orillia, at light, (Grant).

2,766. *Melipotis fasciolaris*, Hbn. Ottawa, at rest in yard, July 6, (Baldwin). A remarkable capture. The species is a native of the West Indies

and was probably brought in with bananas. The Ottawa Fruit Exchange building is close to Mr. Baldwin's house.

2,788. *Syneda ochracea*, Behr. Vernon, June, (Venables).

2,844. *Catocala augusta*, Hy. Edw. Kaslo, (Cockle).

2,858. *Catocala coccinata*, Grt. Cartwright, two or three each year. This is much smaller than *parta*, though like it at first sight, (Heath).

Bomolocha lutalba, Sm. Cartwright, July 10, (Heath).

3,072. *Bomolocha toreuta*, Grt. Aweme, June 18, (Criddle).

3,128. *Dasylophia thyatiroides*, Wlk. Ottawa, June 24, (Young); Toronto, June 6, (Gibson).

3,147. *Ianassa pallida*, Strk. Kaslo, Aug. 3, (Cockle).

3,211. *Tolype laricis*, Fitch. Orillia, two specimens at light, (Grant).

3,226. *Oreta rosea*, Wlk. St. John's, Que., July 29, (Chagnon). The larva feeds on *Viburnum cassinoides* in peat bogs.

6,606. *Sthenopis thule*, Strk. Ottawa, July 6, (Gibson). This is the only specimen so far known with certainty to have been taken at any other place than Montreal. Mr. Gibson also saw two more specimens the following evening; but, although sought for carefully then and for several days afterwards, no others were seen.

6,608. *Hepialus hyperboreus*, Moesch. Kaslo, one specimen, bright reddish orange, no silver, (Cockle).

Coleoptera.

(Arranged according to Henshaw's List of the Coleoptera of America, North of Mexico.

25f. *Cicindela limbalis*, Kl. Calgary, May 17, (Willing).

34. *Cincindela pusilla*, Say. Rounthwaite, Man., Aug. 24, (Marmont), Vernon, B.C., an almost immaculate specimen, (Venables); Okanagan Falls, B.C., July 20, 1895, (Fletcher).

156. *Elaphrus Lecontei*, Crotch. Olds, Alta., June, (Willing).

184. *Nebria diversa*, Lec. Albert Head, Vancouver Island, B.C., Aug. 1, under drift among sand dunes, very active and pale in color like the sand, (Hanham).

1,216. *Amphizoa Lecontei*, Matth. Vernon, (Venables). Quite a rare species, but known from several places in the Rocky Mountain system (Wickham.)

1,696. *Necrophorus Sayi*, Lap. Montreal, Sept. 27, at light, (Chagnon).

1,707. *Silpha trituberculata*, Kirby. Tofield, Alta., July 27, (Willing).

2,180. *Philonthus discoideus*, Gray. Trenton, Aug. 20, (Evans); Ottawa, one specimen, (Harrington).

2,115. *Quedius vernix*, Lec. Montreal, under dead leaves, Sept. 2, (Chagnon).

2,128. *Staphylinus erythropterus*, L. Ottawa, flying, May 4, (Gibson). This rare and beautiful species resembles *badipes*, but has red elytra and two rows of golden spots, one down each side of dorsum.

2,434. *Stenus croceatus*, Casey. Trenton, Sept. 17, (Evans); Ottawa, Oct. 10, (Harrington).

2,825. *Lathrimæum pictum*, Fauv. Goldstream, B.C., abundant in Skunk cabbage, *Lysichiton*, early in the season, (Hanham).

2,854. *Homalium rufipes*, Fauv. Trenton, May 15, (Evans).

3,043a. *Hippodamia mœsta*, Lec. Goldstream, Victoria, a late summer species, rare, found on thistles, etc., (Hanham).

3,118. *Hyperaspis postica,* Lec. Goldstream, by sweeping, August, (Hanham). Described from California.

3,168. *Scymnus Phelpsii,* Cr. Victoria, on fences, Sept., (Hanham).

3,179. *Phymaphora pulchella,* Newm. Montreal, on dead birch partly covered with fungi, Sept. 29, (Chagnon).

3,223. *Mycotretus pulchra,* Say. Trenton, Aug. 26, (Evans). Rare at Ottawa in fungus.

3,403. *Triphyllus elongatus,* Lec. Goldstream, early summer, (Hanham).

3,505. *Hister sedecimstriatus,* Say. Montreal, in cow dung, June 15, (Chagnon).

3,971. *Macropogon testaceipennis,* Mots. Goldstream, June 28, beaten off *Arbutus Menziesii* only; rare, (Hanham).

3,984. *Aræopus monachus,* Lec. Vernon, (Venables).

3,993. *Eucinetus terminalis,* Lec. Montreal, from sweepings in marshy land, Sept. 21, (Chagnon).

4,083. *Adelocera profusa,* Canad. Vernon, under pine bark, May, (Venables).

4,218. *Elater nigrinus,* Payk. Trenton, June 20, (Evans).

4,224. *Elater vitiosus,* Lec. St. Hilaire, Que., July 1, (Chagnon); Ottawa, one specimen, (Harrington).

4,247. *Elater obliquus,* Say. Trenton, June 30, (Evans).

4,343. *Melanotus sagittarius,* Lec. Montreal, May 4, (Chagnon); Ottawa, one specimen, in spring, (Harrington).

4,369. *Limonius subauratus,* Lec. Vancouver, May 16, (Harvey).

4,382. *Pityobius anguinus,* Lec. Six specimens of this fine elater were taken at electric light, Ottawa, June 28, (Gibson and Baldwin).

4,474. *Corymbites sagitticollis,* Esp. Vancouver, May 16, (Harvey).

4,498. *Corymbites rotundicollis,* Say. Specimens of the Pacific form that passes by this name were taken by Mr. Hanham at sugar and on fences. (Wickham.)

4,587. *Dicerca sexualis,* Cr. Vancouver, June 20, (Harvey).

4,738. *Agrilus acutipennis,* Mann. St. John's, Que., June 25, (Chagnon).

4,836. *Photinus marginellus,* Lec. Rare at Ottawa, (Harrington); Trenton, Aug. 8, (Evans).

5,020. *Endeodes collaris,* Lec. Albert Head, Victoria, Aug. 3, on sandy beach under moist seaweed, (Hanham); all of our species of *Endeodes* are found in such locations along the Pacific coast and are remarkable for their curious short elytra. (Wickham.)

5,164. *Clerus spinolæ,* Lec. Victoria, (Anderson).

5,177. *Clerus nigriventris,* Lec. Vernon, (Venables).

5,356. *Amphicerus bicaudatus,* Say. Regina, Oct. 6, 1900, (Willing).
Donoderus pacificus, Casey. Banff, Alta., July 13, (Willing).

5,432. *Canthon simplex.* Lec. Vernon, (Harvey).

5,439. *Onthophagus janus,* Panz. Trenton, May 9, (Evans).

5,557. *Aphodius scabiceps,* Lec. Aweme, Sept. 19, (Criddle). Described from Colorado and so far not reported from any other locality. (Wickham.)

5,659. *Dichelonycha testacea,* Kirby. Saltcoats, N.W.T., July 12, (Willing).

6,233. *Centrodera decolorata,* Harr. Montreal, June 14, at light, (Chagnon).

6,428. *Liopus fascicularis,* Harr. Trenton, July 9, rare, (Evans).

6,478. *Saperda calcarata,* Say, var. *adspersa,* Lec. St. John's, Que., Aug. 27, (Chagnon).

6,560 (10,337). *Syneta hamata,* Horn. Vernon, May, (Venables).

6,599. *Saxinis saucia,* Lec. Vernon, (Venables).

6,959. *Disonycha rufa,* Ill. St. Hilaire, Que., on willows, June 28, (Chagnon).

7,303. *Cœlus ciliatus,* Esch. Victoria. Prof. Wickham so names the species I recorded as *globosus* in last Ent. Record. (Hanham.)

7,396. *Cœlocnemis dilaticollis,* Mann. Goldstream. This is our largest Tenebrionid. It ocurs rarely on dry hillsides under logs, etc., August and later, (Hanham).

7,484. *Uloma longula,* Lec. Goldstream, July, under bark of fallen Douglas fir, (Hanham).

7,666. *Serropalpus barbatus,* Schall. Oak Bay, Victoria, B.C., Sept. 1, at sugar, (Hanham).

7,724. *Calopus augustus,* Lec. Enderby, B.C., April, (Venables).

7,729. *Ditylus gracilis,* Lec. Vancouver, (Harvey).

Xanthochroa testacea, Horn. Albert Head, beaten from *Spiræa,* July 31, (Hanham). As yet this Œdemerid is rare in collections. (Wickham.)

7,872. *Eurygenius campanulatus,* Lec. Goldstream, June, only taken on the ground in cultivated fields, (Hanham).

7,874. *Stereopalpus vestitus,* Say (*badiipennis,* Lec.). Sandhills near the big Douglas swamp, Manitoba, June, (Hanham).

8,240. *Trigonoscuta pilosa,* Mots. Victoria, among roots on sea beach, one pair, (Hanham). Not uncommon further south, but this Vancouver Island record is of interest. (Wickham.)

8,270. *Amnesia decorata,* Lec. Goldstream, occasional under stones, (Hanham).

8,349. *Sitones crinitus,* Gyll. (following LeConte). Olds, June 5, (Willing).

8,357. *Trichalophus simplex,* Lec. Regina, July and August, (Willing).

8,526. *Cleonus vittatus,* Kirby. Victoria, one pair, (Hanham). Uncommon so far north. (Wickham.)

8,641. *Anthonomus sycophanta,* Kirby. Olds, in a gall on willow, Sept. 5, (Willing). Occurs from New Hampshire to District of Columbia, from Oregon to Southern California. (Wickham.)

8,687. *Proctorus armatus,* Lec. North of Olds, June. Prof. Wickham says this is very rare in collections, (Willing).

9,207. *Allandrus bifasciatus,* Lec. Abernethy, N.W.T., June 28, (Willing).

Orthoptera.

Some collections have been made of Orthoptera, but even yet this important field for good work is almost untouched. Dr. Walker, of Toronto, has been in Europe during the greater part of the past collecting season; but one or two other students have taken up the study, and it is probable that next year will show a considerable advance in our knowledge of Canadian locusts and their allies. The following records of species of some interest have been received:—

Ageneotettix Scudderii, Brun. Aweme, Aug. 1, (Criddle).

Amphitornus bicolor, Thom. Aweme, July 21, Aug. 1, (Criddle).

Arphia pseudonietana, Thom. Aug. 12, Vernon, (Venables).

Chloealtis conspersa, Harr. This is *conspersa,* but is colored like the western *abdominalis.* The sides of the pronotum are not shining black as in

all the specimens of *conspersa* I have seen before, but are dark only in the upper half as in *abdominalis*. The latter is a Rocky Mountain form which I have taken at Banff and in Manitoba, and also along the Severn River, Ont. (Walker.) The above specimens were taken on Anticosti Island by Dr. J. Schmitt in 1903.

Chloealtis conspersa, Harr., var. *prima*, Morse. Grimsby, Ont., Aug. 22, 1904, (Metcalfe), also recorded from Lake Simcoe by Walker. (A. N. Caudell.)

Conocephalus nebrascensis, Brun. Grimsby, Aug. 12, Sept. 3, 1894, (Metcalfe).

Cordillacris cinerea, Brun. Aweme, July 7, Aug. 8, (Criddle).

Gomphocerus clavatus, Thom. New Lunnon, Alta., July 22, (Fletcher); Aweme, (Criddle).

Hippiscus latifasciatus, Scudd. Aweme, June 15, (Criddle).

Hippiscus tigrinus, Scudd. Aweme, May 25, (Criddle).

Mecostethus gracilis, Scudd. New Lunnon, Alta., July 27, (Fletcher); Aweme, Sept. 6, (Criddle).

Mecostethus lineatus, Scudd. Anticosti Island, (Dr. Schmitt). Male and female. These differ from Ontario specimens in having a dark ring on the hind tibiæ near the base, and in the shorter tegmina and wings; the female also differs in the pronotum, which is more contracted before the middle. (E. M. Walker.)

Melanoplus bilituratus, Walk. Aweme, July 4, (Fletcher and Criddle).

Melanoplus Dawsoni tellustris, Scudd. Aweme, (Criddle).

Melanoplus extremus junius, Dodge. Aweme, July 7, (Criddle and Fletcher).

Melanoplus fasciatus volaticus, Scudd. Edmonton, Alta., (Fletcher).

Nemobius griseus, Walk. Toronto, Oct. 8, 1903, (Metcalfe).

Spharagemon Bolli, Scudd. Aweme, July 27, (Criddle).

Stenobothrus acutus, Morse. Edmonton, Alta., (Fletcher).

Stirapleura decussata, Scudd. Aweme, May 24, (Criddle).

Tettix ornatus triangularis, Scudd. Toronto, April 4, 1904, (Metcalfe).

Trimerotropis citrina, Scudd. Vernon, B.C., Aug. 25, (Venables).

Odonata.

This order has not yet received from Canadian entomologists the attention which it deserves; but an effort will be made to draw more attention to it, as there are doubtless a great many interesting species in Canada which have not yet been recorded. The few collections which have been submitted to specialists, have all contained species of interest, and this attractive order presents a field well worthy of study. The life-histories of many species are unknown, and the habits of the larvæ of all make them very desirable objects for an aquarium. Dr. E. M. Walker, of Toronto, has collected for some time and has now a collection of about 65 species found in Ontario. He has kindly named any specimens I have submitted to him, and the following notes are made from letters which he has written. The species mentioned are the most interesting of a large number which have been submitted to him or which he has taken himself recently.

Calopteryx æquabilis, Say. Algonquin Park, Ont., July 25, 1900, (Prof. John Macoun). The same locality, Aug. 31, 1902, (Dr. E. M. Walker).

Ophiogomphus rupinsulensis, Walsh. North River, Algonquin Park, Aug. 13 to 30, 1902-03, (Walker).

Hagenius brevistylus, Selys. Lake Simcoe, July, Algonquin Park, Aug. 20, (Walker).

Lanthus albistylus, Selys. North River, Algonquin Park, Aug. 14, (Walker).

Somatochlora forcipata, Scudd. A very rare and interesting species of northern range. One male, Algonquin Park, July 15, (Macoun); Isle of Orleans, Que., Aug. 30, (Walker).

Gomphus Scudderi, Selys. North River, Algonquin Park, Aug. 20, 1903; Aug. 30, 1902, (Walker).

Gomphus furcifer, Hagen. High Park and East Toronto, June 15, (Walker).

Dromogomphus spinosus, Selys. Lake Simcoe, July to Sept., (Walker).

Macromia illinoiensis, Walsh. Lake Simcoe, July to August, Algonquin Park, Aug., (Walker).

Dorocordulia libera, Selys. Lake Simcoe, July 8, (Walker).

Ladona julia, Uhler. Algonquin Park, July 5, (Macoun).

Tramea carolina, L. One male of this fine large southern dragon fly was taken by Dr. E. M. Walker, in High Park, Toronto, May 24, 1904.

Diptera.

(Arranged according to a Catalogue of North American Diptera by J. M. Aldrich (Smithsonian Mis. Col. XLVI. No. 1,444.) The numbers refer to the pages of the Catalogue.)

166. *Bibio nigripilus*, Loew. Common in April, Vancouver, (Harvey); Victoria, (Anderson).

179. *Sargus decorus*, Say. Victoria, (Anderson).

202. *Tabanus captonis*, Marten. Mt. Arrowsmith, B.C., July 28, (Fletcher).

203. *Tabanus epistatus*, O. S. Sumner, N.W.T., June 23, 1903, (Willing); Deloraine, Man., Ottawa, June 23, 1903, (Fletcher).

204. *Tabanus illotus*, O. S. Moosomin, N.W.T., June 23; Tantallon, N.W.T., July 23; Prince Albert, N.W.T., July 23, (Willing); Indian Head, N.W.T., July 1, (Fletcher).

204. *Tabanus lasiophthalmus*, MacG. Ottawa, 29 May, (Fletcher).

204. *Tabanus lineola*, Fab. Ottawa, Aug. 8, (Fletcher).

Tabanus Osburni, Hine. Deloraine, Man., 1902, (Fletcher).

207. *Tabanus Reinwardtii*, Wied. Millarville, Alta., July 27, 1903, (Dod).

207. *Tabanus septentrionalis*, Loew. McLeod, Pincher, Pine Creek, Spruce Grove, Tofield, all N.W.T., July 2-27, (Willing).

207. *Tabanus sonomensis*, O. S. June 20, Vancouver, (Harvey); Mt. Arrowsmith, B.C., July 28, (Fletcher).

209. *Tabanus vivax*, O. S. Little Current River, Hudson Bay slope, 22 July, 1903, (Wilson).

209. *Tabanus zonalis*, Kirby. Mamamattawa, Hudson Bay slope, 21 June, 1903, (Wilson).

230. *Anthrax eumenes*, O. S. Victoria, (Anderson).

259. *Cyrtopogon dasylloides*, Will. Victoria, (Anderson).

351. *Paragus bicolor*, Fab. Victoria, (Anderson).

352. *Chilosia lasiophthalmus*, Will. Victoria, (Anderson).

361. *Melanostoma stegnum*, Say. Common, end of April, Vancouver, (Harvey).

363. *Didea laxa*, O. S. One male, April 24, Vancouver, (Harvey).

363. *Lasiophthalmus pyrastri*, L. Victoria, (Anderson).

364. *Syrphus americanus*, Wied. Common, April-May, Vancouver, (Harvey).

365. *Syrphus diversipes*, Macq. Common, April-May, Vancouver, (Harvey).

366. *Syrphus macularis*, Zett. Victoria, (Anderson).

366. *Syrphus intrudens*, O. S. Common, April-May, Vancouver, (Harvey).

368. *Syrphus torvus*, O. S. Common, April-May, Vancouver, (Harvey).

382. *Sericomyia chalcopyga*, Loew. Victoria, (Anderson).

383. *Pyritis Kincaidii*, Coq. Victoria, (Anderson).

400. *Chrysochlamys crœsus*, O. S. Victoria, (Anderson).

402. *Criorhina Kincaidi*, Coq. Common, March to May, at willows and salmon-berry, *Rubus spectabilis*, Vancouver, (Harvey).

403. *Criorhina tricolor*, Coq. Two at end of May, Vancouver, (Harvey).

404. *Spilomyia fusca*, Loew. One pair, Trenton, Ont., Aug. 27, (Evans).

430. *Clausicella Johnsoni*, Coq. Ottawa, 26 June, (Metcalfe).

472. *Blepharipeza adusta*, Loew. April 30, Vancouver, (Harvey).

489. *Epalpus bicolor*, Will. One, Sept., Vancouver, (Harvey).

520. *Calliphora viridescens*, Desv. Victoria, (Anderson).

525. *Pyrellia cyanicolor*, Zett. Common, April, Vancouver, (Harvey).

563. *Lispa tentaculata*, De G. Victoria, (Anderson).

A good many flies have been collected during 1905, but very few of the eastern records sent in are of special interest. Those given above are almost all from the west, and most of them are additions to the Canadian list. All the identifications have been made by leading specialists.

INJURIOUS INSECTS OF THE FLOWER GARDEN.

By Arthur Gibson, Division of Entomology, Central Experimental Farm, Ottawa.

Growers of flowering plants in gardens are often troubled with insect enemies of various kinds. Some of these attack the foliage, others the flowers, while others again bore into the stems and even into the roots. As the subject is an important one, an effort has been made to bring together such information as we had concerning certain little-known species, and to add, at the same time, short notes on some of the more regularly occurring pests in flower gardens, some of which may appear in destructive numbers during any season.

Injurious insects may be divided into two classes: (1) those kinds which bite their food, such as caterpillars, beetles, etc., and (2) those which suck up their food in a liquid form, by means of their beaks, such as the true bugs, plant lice, etc. When insects, therefore, are noticed doing harm to any plant, the first thing to do is to decide by the nature of the injury to what class they belong. If they are biting insects, some poison, such as Paris green, must be placed upon the food which will be eaten with it. If, however, they are sucking insects, some material which will kill by contact, such as kerosene emulsion, or whale oil soap, must be used. For the convenience of applying liquid applications to the foliage of plants a small spraying pump will be found useful. Good hand pumps suitable for use in ordinary flower gardens may be now purchased at a small cost, but it will pay in the end to get a good pump, even if this should be a few dollars more.

There are some insects, such as the borers, which cannot be reached by any outside application of spraying materials. Injury to plants by these insects, which work inside the stems and roots, is often of a serious nature

and should be met with preventive remedies. In some cases the only thing to do is to cut out the infested part if this is possible, or destroy the whole plant so as to reduce the numbers of the insect.

It must be remembered, however, that all insects which occur in gardens are not injurious kinds. There are beneficial ones as well, which are continually doing good by destroying those species which do harm. These beneficial kinds should all be known to the gardener. Foremost amongst them are the different kinds of ladybird beetles (Fig. 35), which, both in their larval and adult stages feed almost exclusively upon plant-lice and scale insects.

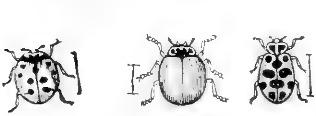

Fig. 35. Lady-bird beetles.

Fig. 36. Lace-wing fly; eggs much magnified; the fly, showing one pair of wings only; the eggs on their stalks; the larva.

Another kind of beetle, the Fiery Ground beetle, *Calosoma calidum*, Fab., is a particularly useful insect. This beetle, and its voracious black grub, which is called the Cutworm Lion, destroy enormous numbers of cutworms. The beetle shown in the figure is brownish black, with the wing cases spotted with coppery red in nearly all the eastern specimens. The appearance and habits of this good friend should be known to everyone. (Fig. 37.)

Other well-known beneficial insects belong to the parasitic Hymenoptera, four-winged flies, and to the Diptera, or two-winged flies. The females of these large groups of flies deposit their eggs upon or in the bodies of cutworms and other injurious caterpillars. These eggs soon hatch and the young larvæ at once begin to feed upon the living caterpillar, which of course soon dies. The different kinds of Lace-wing flies (Chrysopa species) (Fig. 36) are also good friends of the gardener, their larvæ working particularly among the plant lice.

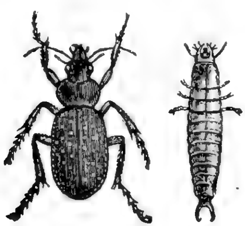

Fig. 37. The Fiery Ground-beetle and its larva, the Cutworm Lion.

Fig. 38. Agrotis ypsilon; cut worm and moth.

INSECT PESTS OF IMPORTANCE.

Cutworms. These destructive insects are very troublesome in flower gardens, and when they are at all abundant no plants seem to be exempt from their attacks. The moths of some of the species lay their eggs in fall, others in spring, and some species pass the winter either as a pupa or a half-grown

larva. Their ravages are most noticeable in the spring, just as young seedlings appear above the ground, or when annual plants have been set out. As they feed chiefly at night, their injury is quite apparent in the morning, when plants may be seen to have been cut or eaten off at the surface, or even a little below it. If the earth around such plants is examined, coiled up, dirty gray, or reddish brown, smooth caterpillars, about an inch or more in length, will be seen. Around some plants the writer has found as many as nineteen. They are all of some dull shade of color similar to the ground in which they hide during the day. When they occur in large numbers and their food supply is short, they feed by day as well as by night. In Ontario the two kinds which have given the most trouble in flower gardens are the Red-backed Cutworm, *Paragrotis ochrogaster*, Gn., and the Dark-sided Cutworm *Paragrotis messoria*, Harr. These two cutworms often occur together and it is sometimes difficult to distinguish between the two. Other cutworms which are present in some numbers almost every season, and which occasionally do serious damage, are the White Cutworm, *Paragrotis scandens*, Riley, the Spotted Cutworm, *Noctua c-nigrum*, L., and the Greasy Cutworm, *Agrotis ypsilon*, Rott. (Fig. 38). The Variable Cutworm, *Mamestra atlantica*, Grt., the moths of which are very abundant some seasons, may at any time do harm. (Fig. 39 shows another common moth of this family.)

During the past season, another kind of cutworm, that of *Barathra occidentata*, Grt., made its first appearance in Canada as a pest of importance. The moths of this species were very abundant at Ottawa in June, and later the larvæ appeared in considerable numbers and did serious damage to larkspurs, bleeding hearts, pansies, violets, etc.

As the habits of cutworms are very similar, the same remedy is applicable to all the species. As soon as their presence in a garden is detected, the well-known poisoned bran remedy, which has lately come into such wide use, should be applied. This is made by simply moistening some bran with a little sweetened water and gently dusting in Paris green, so that all the particles of the bran will be poisoned. The whole should be mixed thoroughly together and then placed in small quantities near, but not touching, the plants to be protected. Half a pound of Paris green is sufficient to poison fifty pounds of bran.

Fig. 39. Agrotis Subgothica.

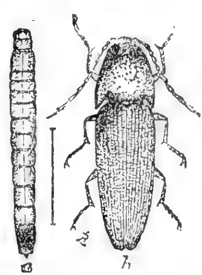

Fig. 40. Wire worm and beetle.

White Grubs. (*Lachnosterna.*) The roots of many kinds of flowering plants are often eaten by the larvæ of May Beetles, or June Bugs. These larvæ, which are known as White Grubs, usually occur in land which has been in sod for several years. (See Fig. 6.) During the past season at Ottawa the roots of asters and other annuals were eaten, causing the death of

many plants. As these White Grubs take so long to come to maturity, there is no time during the growing season that they do not attack plants. Unfortunately the only remedy which has given any degree of success in garden practice, is the ploughing or digging up of the land in late autumn, by which time the larvæ will have made their winter cells; but where many perennials are grown this would be difficult. This disturbing of the soil in autumn breaks up their cells and exposes the larvæ and pupæ to the cold of winter. In spring, when the ground is dug again, all White Grubs seen should be picked up and destroyed. At this time if it is at all possible, should the infestation be severe, poultry or pigs may be turned into the garden. These animals are very fond of White Grubs and it is claimed they will soon rid a piece of land of them. In cities and towns it would hardly be possible to use pigs for this purpose, but poultry might in many cases be used to advantage.

WIREWORMS. (Fig. 40.) Occurring sometimes with White Grubs, but more often by themselves, are slender yellowish, or reddish-brown, shining grubs, which feed on the roots of almost all kinds of plants, and have somewhat the same habits as the White Grubs. These are Wireworms, the larvæ of the Click-beetles. The digging up or disturbing of the soil twice in autumn, first in August, to destroy the tender pupæ, and in October or later, which will expose the newly formed beetles to the cold of winter, as mentioned under White Grubs, is also of use in reducing the numbers of this class of insects.

TARNISHED PLANT BUG. *Lygus pratensis*, L. This common plant bug is troublesome, more or less, in gardens almost every season. When it is very abundant it is a difficult insect to combat. It not only sucks the juices from the leaves, but also attacks the flowers of many annual and perennial plants, causing them to become distorted. The spraying of the infested plants with kerosene emulsion or whale oil soap may be resorted to, or they may be dusted with insect powder, but these remedies are not always satisfactory. These bugs are most active during the heat of the day, but in the early morning they are comparatively sluggish, at which time they may be beaten off the plants into an inverted umbrella and then put into some receptacle containing coal oil and water. As this insect passes the winter in the perfect state, all garden rubbish should be burned in the fall. This practice of cleaning up gardens is important, as it reduces the shelters which harbor this and many other kinds of injurious insects.

THE FOUR-LINED LEAF-BUG. *Pœcilocapsus lineatus*, Fab. Another plant bug which is very destructive at times, and which is a bright greenish-yellow insect, three-tenths of an inch long, with two black spots on the thorax and four stripes of the same color down the back, is the Four-lined Leaf-bug. This insect, unlike the Tarnished Plant Bug, passes the winter in the egg state, the eggs being laid in the autumn in the terminal twigs of currant and other bushes. The eggs hatch the following spring and the young nymphs at once begin to feed on the foliage, which soon becomes spotted with brown. The eggs are white and once they are known, it does not take very long to look over a bush and clip off the shoots containing them. When the insects have been troublesome during the summer, the eggs should be looked for in the fall and destroyed. A strong kerosene emulsion (1 to 6) will reduce the numbers of the nymphs and perfect insects. Pyrethrum insect powder dusted on the plants is also useful, as well as the beating of the insects into open pans containing coal oil and water. The plants most attacked in gardens are sage, mint, gooseberry, currant, weigelias, dahlias and snap-dragon.

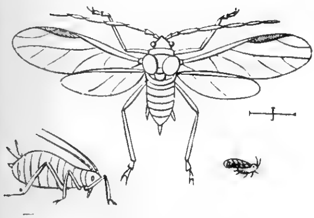

Fig. 41. Plant-lice.

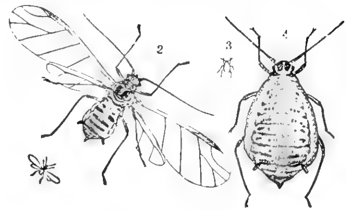

Fig. 42. Plant-lice.

PLANT LICE. (Figs. 41 and 42.) This class of injurious insects, which are chiefly known from their attacks on shrubs and trees of various kinds, as well as upon plants in vegetable gardens, are every year the cause of much damage in flower gardens. Some seasons their injuries are very serious, the growth of many flowering plants being stunted or completely destroyed. There are a great many different kinds of plant lice, or aphids, in Canada, but most of these have in general the same feeding habits. They are all sucking insects and live solely on the juices which they extract from their host plant. Some kinds feed on the under side of the foliage, others cluster on the stems of plants, and others again are found attacking the roots. Those which feed on the foliage often cause the leaves to curl and become conspicuously distorted.

One species in particular about which much enquiry is made in Ontario, is the Snowball Plant-louse. Large clusters of these insects are found on the under surface of the leaves, which soon become drawn up, giving a very unsightly appearance to this beautiful and popular bush.

When plant lice are first noticed the plants should be sprayed with kerosene emulsion, or whale oil soap. The dark kinds are the more difficult to kill, and the solution used will have to be stronger. Whale oil soap, one pound in four gallons of water, will be necessary. During the past year some new methods of making kerosene emulsion have been devised by Mr. F. T. Shutt, Chemist at the Central Experimental Farm, Ottawa. One of these emulsions is worthy of notice here and is particularly applicable for immediate use in gardens and over small areas. This is made by mixing two ounces of flour in a little scalding water, afterwards adding one quart of kerosene, and then two gallons of water, stirring the whole thoroughly for a few minutes.

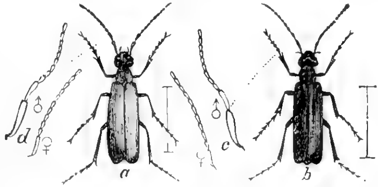

Fig. 43. Blister-beetles.

BLISTER BEETLES, *Epicauta pennsylvanica*, De G., (Fig. 43), *Epicauta vittata*, Fab., (Fig. 44), and *Macrobasis unicolor*, Kirby. These active, soft-bodied, beetles, from their habit of suddenly appearing in large numbers, often do much damage in gardens before their presence is detected. They

have a great variety of food plants, among which are the various kinds of China and German asters, dahlias, and some other Compositæ. As a rule Blister Beetles only do damage in years following excessive locust outbreaks. In their larval state, as is well known, they are predaceous parasites on the eggs of grasshoppers, and therefore when the beetles appear in numbers it is undesirable to destroy them if this can be avoided. Although the attack is generally severe while it lasts, the period during which Blister Beetles injure vegetation is not of long duration, and, besides this, they do not occur injuriously every year. Like other leaf-eating insects, however, these beetles can be destroyed by spraying the plants with a Paris green, or other arsenical, mixture. In small gardens a simpler remedy is to beat them into a pan, or other shallow vessel, containing water with a little coal oil on the top.

Fig. 44. Striped Blister-beetle.

Fig. 45. Flea-beetle. (Much enlarged.)

Fig. 46. Rose beetle.

Flea-Beetles. (Fig. 45.) The foliage of some kinds of garden plants is often partly, or wholly, devoured by small active beetles, which leap like fleas, owing to which habit they are known by the name of flea-beetles. There are a number of different species in Canada, two of which specially are responsible for much damage. In early spring at Ottawa, the white flowers of the favorite border and rockery plant, Alpine Rock Cress, *Arabis alpina*, L., are nearly every year injured, some seasons very seriously, by *Phyllotreta vittata*, Fab., which, on account of its great destructiveness to the leaves of turnips, is called the Turnip Flea-beetle. The perfect beetles are about one-eighth of an inch long and in color are black, shining, with yellowish marks on the wings. On several occasions the Red-headed Flea-beetle, *Systena frontalis*, Fab., has been the cause of much injury in the Botanic Garden of the Central Experimental Farm. (Report Entomologist and Botanist, Dom. Exp. Farms, 1889.) Young plants and low shrubs of a great many orders were attacked, their ravages being particularly to some species of *Althæa, Hibiscus* and *Weigelia*. Injury was all done by the perfect beetles, few plants appearing to come amiss to them. This flea-beetle is about one-fourth of an inch long and has a black head with a red patch on the top of the head in front. In August last the beetles were very abundant at Ottawa, particularly on the second crop of clover. Another flea-beetle which has not yet been identified is occasionally destructive at Ottawa to Forget-me-nots. Paris green and land plaster, or flour, in the proportion of one pound of the former to twenty of the dry diluent, dusted on infested plants, if possible when they are covered with dew, is one of the best remedies against these troublesome insects. The ordinary poisoned Bordeaux mixture is particularly effective against flea-beetles when applied as a spray, and indeed has been found to be by far the best remedy for controlling the Potato Flea-beetle, *Epitrix cucumeris*, Harr.

The Rose Beetle, *Macrodactylus subspinosus*, Fab. (Fig. 46.) This common enemy of the fruit-grower, known also as the "Rose-chafer" and "Rose-bug," which every year does so much harm in vineyards and orchards,

is often very destructive to the flowers of rose bushes, as well as to the bloom of many other kinds of flowering plants. In Ontario this insect has been particularly abundant in the Niagara district. The mature beetles last for about five weeks and when present in large numbers are very difficult to get rid of. It has been found, however, by Prof. F. M. Webster that 95 per cent. of the adult beetles may be killed by spraying them with half a pound of fish-oil soap in a gallon of water. The suds must be thrown directly onto the beetles while they are clustered on the flowers. This remedy of course is only useful in killing the beetles on the plants; it has no effect in keeping them off afterwards. These beetles, although very active during the hot hours of the day, are sluggish early in the morning, and at this time may be easily beaten from the plants into an inverted umbrella and then emptied into some vessel containing water with coal oil on the surface. Rose bushes may be protected by covering them with netting.

THE AMERICAN ROSE-SLUG, *Endelomyia (Selandria) rosæ*, Harr. Occurring commonly in Ontario, and doing considerable damage every year to the foliage of roses, is a slug-like larva about one-third of an inch long, green in colour, swollen near the head, but not slimy as is the case with many other allied saw-fly larvæ. This false caterpillar is nocturnal in habit, and feeds on the upper side of a leaf, but during the day, when at rest, may be found concealed on the under-surface of the leaf. Infested plants will soon show the presence of these slug-like larvæ from the foliage becoming conspicuously skeletonized. These rose slugs may be easily destroyed by dusting the plants with white hellebore, or spraying them with a mixture of two ounces of hellebore to every two gallons of water. A weak solution of Paris green, one ounce in fifteen gallons of water, is also very effective.

THE BRISTLY ROSE-WORM, *Cladius pectinicornis*, Fourcr. Another saw-fly larva which is abundant in Ontario, and which, at Ottawa, is the commonest of the three rose saw-flies mentioned in this article, is the Bristly Rose-worm. This larva, when full grown, is about two-thirds of an inch long, and ranges in colour from dirty yellowish-green to a glaucous-green, with a darker green line down the back. This false caterpillar is covered with stiff hairs, which give it a conspicuous bristly appearance. The larva, when young, works very much in the same way as the Rose-slug, skeletonizing the leaves, and leaving whitish blotches. As it grows older, however, it eats out irregular holes all over the leaf, often consuming the whole substance, except the stronger ribs. The same remedies used for the Rose-slug are applicable for this insect.

THE CURLED ROSE-WORM, *Emphytus cinctipes*, Nort. This rose-worm is also common all through Ontario wherever roses are grown, and, like the two preceding species, is an important enemy of that plant. The larva is easily distinguished from either of the other two kinds mentioned above, being smooth, and in having a yellowish brown head marked with a broad brownish-black spot. The body is dark green above, with the sides and legs grayish-white. This larva eats the entire substance of the leaf, feeding along the edges, with the body curled beneath it. When at rest it remains curled up on the under-surface of the leaf. Hellebore, or a weak solution of Paris green, is also recommended for the Curled Rose-worm.

THE SMALL WHITE CABBAGE BUTTERFLY, *Pontia rapae*, L. (Fig. 48). This pest of the market gardener, which now occurs right through Canada, not infrequently requires attention in flower gardens, from its ravages to stocks and other crucifers, mignonettes, nasturtiums and spider flower (*Cleome*). These velvety green caterpillars about an inch in length, with a

broken yellow line along each side and an unbroken one down the middle of the back (Fig. 47), are particularly destructive to mignonettes, some seasons it being almost impossible to grow good plants. The insect is, however, an easy one to control. The dusting of infested plants with pyrethrum insect powder is about the best remedy for the caterpillars of this common butterfly. This preparation can be made by mixing thoroughly one part of weight of the insect powder with four parts of cheap flour, keeping the whole in a closed vessel for at least 24 hours. The mixture can then be distributed easily by placing it in a small bag of fine muslin which can be tied to the end of a short stick so that it swings freely. If the bag is tapped lightly with another stick held in the other hand, many plants can be gone over quickly and without tiring the operator. Many florists and seedsmen now sell proper bellows or dusters for applying dry powders, and these are not very expensive.

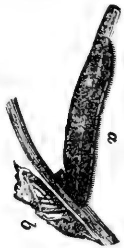

Fig. 47. Pontia rapæ: *a*, caterpillar; *b*, chrysalis.

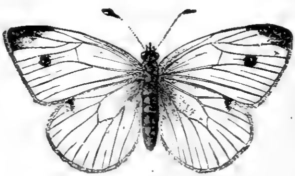
Fig. 48. White Cabbage butterfly.

The Diamond-Back Moth, (*Plutella maculipennis*, Curtis, *Plutella cruciferarum*, Zell. (See Fig. 33.) This well-known enemy of the market gardener, during some seasons does serious harm to wall-flowers, stocks, and other crucifers. The caterpillar which is from one quarter to three-eighths of an inch in length is green and very active. It is particularly abundant during July and August, but fortunately occurs irregularly, being doubtless held in check by parasites. These small caterpillars when disturbed run backwards, wriggling their bodies from side to side, and when they reach the edge of a leaf, they let themselves down by means of a silken thread. In garden practice infested plants may be sprayed with kerosene emulsion, or a soap mixture, to which Paris green or some other active poison has been added, the spray to be forced well up under the leaves if possible.

The Zebra Caterpillar, *Mamestra picta*, Harr. (See Fig. 2.) This common enemy of turnips, cabbages, clover, etc. is sometimes troublesome in flower gardens. In his 1896 annual report, Dr. Fletcher spoke of a serious infestation at Ottawa, the plants attacked in gardens being sweet peas, lilies, gladioli; in fact it was stated that the larvæ attacked indiscriminately almost all the annuals. On Oct. 3rd of the present year, the writer noticed the species feeding on asters. The caterpillar is a handsome one, about two inches long when full grown, velvety black on the back and having two golden yellow stripes on each side of the body, which are connected by narrow lines of the same colour, the head and feet bright reddish brown. When young the larvæ for a time feed together, but as they grow larger they separate and feed singly. There are two broods of the insect in the year, the second one of which occurs in September, and is the most troublesome. A remedy for these caterpillars is to spray infested plants with Paris green, one ounce in

10 gallons of water. Dusting the plants with pyrethrum insect powder is also useful. If only a few specimens are found in a garden, they can of course be removed by hand and destroyed.

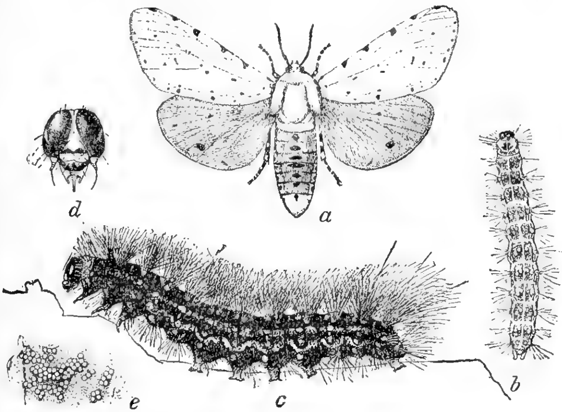

Fig. 49. Salt-marsh caterpillar and moth. (Chittenden, Bull. 43, Div. of Ent., U.S. Dep. Agr.)

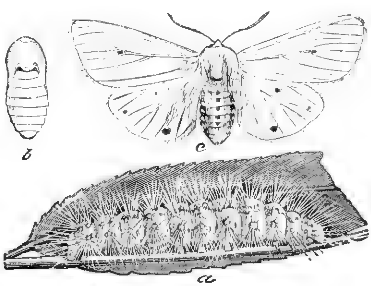

Fig. 50. The Yellow Woolly-Bear: *a*, caterpillar; *b*, chrysalis; *c*, moth.

Woolly-Bears. The caterpillars, or "woolly-bears," of two kinds of arctian moths, commonly occur in gardens, occasionally in sufficient numbers to demand attention. These are the Salt-Marsh Caterpillar, *Estigmene acræa*, Dru., (Fig. 49) and the Yellow Woolly-Bear, *Diacrisia virginica*, Fab. (Fig. 50.) Both of these caterpillars are, in general, of similar appearance and habits, and feed on a great variety of plants. The former kind is the larger, measuring when full grown about 2½ inches in length, and it differs from the Yellow Woolly-Bear in having a darker body and yellow markings along the sides. These caterpillars, as the name "woolly-bear" indicates, are quite hairy, the hairs of the former being mostly always reddish, or reddish brown, while those of the latter vary considerably, the hairs in some specimens being whitish, or pale yellow, while those in others are reddish, or reddish brown. Injury by these caterpillars is most noticed when they

are in their younger stages during which time they feed together, but as they grow older and reach maturity they separate and wander off by themselves. Hand picking answers as a remedy in most cases, but if the attack should be serious, spraying with Paris green, or any other of the well known arsenical poisons, would soon destroy the larvæ.

The Oyster Shell Scale, *Lepidosaphes ulmi*, L. (Fig. 51). Occurring commonly in some districts in Ontario on rose bushes of many kinds are the oyster-shell shaped scales, which are so well known from injuries by the insects to fruit trees, particularly the apple. Unlike many other kinds of scale insects, the Oyster-shell Bark-louse has only one annual brood, the insect passing the winter in the egg state under the mother scales, and the young larvæ appearing in spring. If rose bushes are found to be heavily infested with this scale insect, they should be sprayed in late fall or early winter with a whitewash mixture, using one pound of unslaked lime to every gallon of water. A second spraying should be applied as soon as the first one is dry. The lime hardens on the bark and flakes off during the winter, taking with it the scales with the clusters of eggs. In June when the young lice hatch they may be easily seen running about on the bark preparatory to settling down. When detected the bushes should be sprayed with kerosene emulsion. A simple formula for making this for immediate use in gardens will be found under the paragraph treating of Plant Lice.

The Rose Scale, *Diaspis rosæ*, Bouche. An unpleasant sight in rose gardens are clusters of roundish white scales which show up conspicuously in contrast to the greenish or reddish shoots of the rose bushes. This scale insect is sometimes very common on neglected bushes, and if not attended to will soon do serious damage. Being a sucking insect kerosene emulsion or whale oil soap are the best remedies. It has only so far occurred in the Province of Ontario around Lake Ontario, its worst attacks being on raspberries.

The Rose Leaf-Hopper, *Typhlocyba rosæ*, L. This common leaf-hopper, which occurs all through the country, wherever roses are grown, is often seen in swarms on the leaves of these bushes. These insects are very small, pale greenish-white, and are often spoken of by the confusing name of "Rose Thrip." Throughout the summer they may be found on the leaves in various stages of development, and are frequently extremely destructive. They can be controlled, however, by spraying the bushes with kerosene emulsion or whale oil soap.

The Grape Vine Leaf-Hopper, *Typhlocyba comes*, Say, *T. vitis*, Harr, etc. An insect which demands much attention every year in Ontario is the Grape Vine Leaf-hopper. Although very destructive to the foliage of grapes, lovers of ornamental plants are often exercised over a small hopping insect which occurs in countless numbers on Virginian Creepers. These insects, also as in the case of the Rose Leaf-hopper, are erroneously spoken of as "Thrip." They are of a translucent white colour prettily marked with red and dark brown lines. In their younger stages they are pale and although lacking wings are almost as active as the full grown insects. These leaf-hoppers pass the winter in the perfect state hidden away amongst fallen leaves and other rubbish. The ground, therefore, should be raked and kept clean during autumn so as to reduce as much as possible the opportunities of these insects wintering near the vines. In all their stages these leaf-hoppers live by suction and therefore can be killed by contact insecticides. Kerosene emulsion and whale oil soap are the best mixtures to use, and the

spraying should be done before the insects develop their wings. When these insects are present on a vine the leaves soon become white in patches and then fall to the ground.

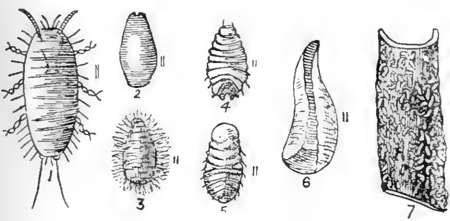

Fig. 51. The Oyster-shell Scale.

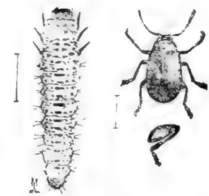

Fig. 52. Grape-vine flea-beetle and larva, much enlarged; also leg, greatly magnified.

Fig. 53. Grape-vine Flea-beetle, showing beetles and larvæ at work.

The Grape Vine Flea-Beetle, *Haltica chalybea*, Ill. (Figs. 52 and 53). This is another well known grape insect, but one which often does much injury in Ontario to the foliage of Virginian creepers. When the dirty, yellowish-brown grubs, which have black shining bristle-bearing tubercles are found on the vines, they may be destroyed by a Paris green spray 1 oz. in 10 gallons of water. All fallen leaves and rubbish should be burned in autumn to prevent the mature beetles from hibernating near the vines.

The Violet Sawfly, *Emphytus canadensis*, Kirby. Pansies and violets, which are always favourites in gardens, are sometimes seriously attacked by the false caterpillars of this sawfly. These larvæ which are smooth and bluish-black in colour are about ½ an inch in length when mature. When in their younger stages they have the habit of eating little holes in the leaves, but as they reach maturity they feed mostly along the edge of a leaf. These false caterpillars when at all numerous do a great deal of harm, oftentimes completely defoliating plants. At Ottawa the species is of common occurrence, some seasons doing considerable damage. Last June and the first half of July the larvæ were very abundant on violets on the grounds of the Central Experimental Farm. In Canada, Dr. Fletcher tells me injuries by the Violet Sawfly, have not been reported from very many localities. In 1898 considerable injury was done in large beds of violets grown under glass in Toronto. As the larvæ feed as a rule during the night, Dr. Fletcher recom-

mends as a remedy, the dusting of the plants in the evening with white hellebore, or with Paris green mixed with 50 times its weight of common flour, or some other dry diluent.

THE OBLIQUE-BANDED LEAF-ROLLER, *Archips rosaceana*, Harr. (Fig. 54). This widely distributed leaf-roller, the caterpillar of one of the tortricine moths, is very common in Ontario and has a great range of food plants. At Ottawa the larvæ have been particularly abundant on apple, and in flower gardens we have found the species on roses, climbing honeysuckles, geraniums, spiraeas, and many other plants. The caterpillar besides rolling up the leaves very often has the habit of tying together the upper leaves and buds of flowering plants and then destroying the flowers. When full grown it is about three-quarters of an inch in length, green, with a darker green dorsal vessel; the head black in front, brownish at the top, as is also the top of the first body segment; the feet all black. This leaf-roller, although common and widespread, has never occurred in gardens in Ontario to require much attention. Handpicking as a rule will serve as a remedy, but if the caterpillars should appear in numbers spraying with some poison would soon destroy them.

Fig. 54. Oblique-banded Leaf-roller moth.

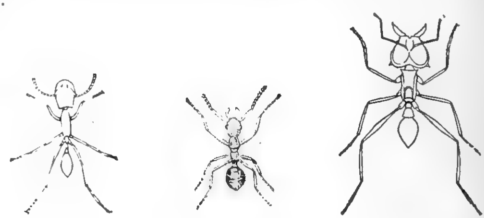

Fig. 55. Ants.

ANTS (Fig. 55). Enquiries are frequently made for information concerning ants which infest garden plants of many kinds. It is generally believed that these insects do harm to plants, but this is not the case. In most instances, if close observation is made, it will be found that plant lice are present and are the real cause of the injury. The relations of ants to plant lice are very interesting. It is well known that ants are protectors of plant lice; they are very fond of the sweet honey dew which is emitted by them, and certain kinds even actually colonize them on plants near or inside their nests. Some ants indirectly, therefore, are very injurious, although they do not themselves feed upon plant tissue. When they are seen to be running about on plants, a search should be made for their nest which will, in all probability, be located in the earth close by. When this is found a tablespoonful of bisulphide of carbon should be poured into it and the opening immediately closed up by stepping on it. The fumes from this liquid will penetrate quickly into all parts of the nest, and not only kill the adults but the larvæ as well. This material is very inflammable and care must be taken not to bring a light near it. Another remedy is to pour scalding water into the nests.

RED SPIDER. Although chiefly a greenhouse pest, these minute mites are often found doing considerable damage to the foliage of plants in flower gardens, particularly during hot, dry seasons. The presence of these small creatures on the plants is easily detected by the leaves losing their colour, having a white, bleached appearance, and becoming stunted. These mites live by sucking out the juices from the leaves and in this way

slowly reduce the vitality of the plants until in many instances they are completely killed. They do not seem to have a preference for any particular kind of plant, but possibly are more noticed, at least in this locality, on verbenas and roses. Some years when they are very bad it is almost impossible to grow verbenas. Probably the best remedy for these mites is to spray the plants with flowers of sulphur in the proportion of one ounce to every gallon of water. As these mites feed chiefly on the under side of leaves, the spray should be forced up among the foliage as much as possible. If only a few plants are found to be infested with red spider, the sulphur may be dusted on to the leaves by means of a small bellows, or other specially made implement, which is now used for such purposes, and sold by many seedsmen.

SNAILS AND SLUGS. These slimy, soft-bodied mollusks which, of course, are not insects, are included in this article, because the entomologist is often asked for information concerning them and particularly for a remedy for their destruction. Every year they are very injurious in flower gardens, and as they come out to feed in the evening an excellent remedy is to broadcast lightly over the soil, before nightfall, freshly slaked lime. This adheres to their bodies and soon kills them. Two or three applications on consecutive evenings will eradicate them thoroughly.

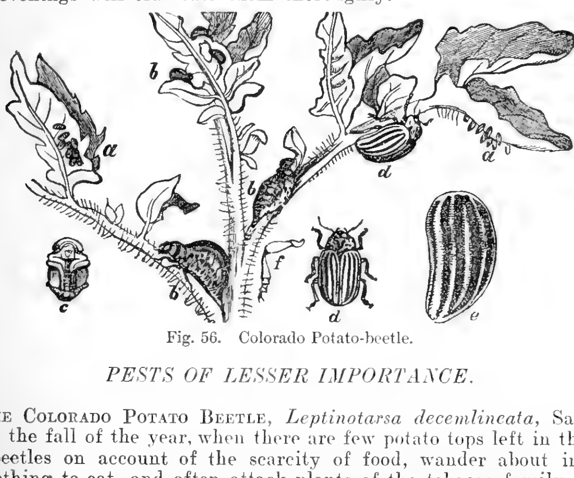

Fig. 56. Colorado Potato-beetle.

PESTS OF LESSER IMPORTANCE.

THE COLORADO POTATO BEETLE, *Leptinotarsa decemlineata*, Say. (Fig. 56). In the fall of the year, when there are few potato tops left in the fields, these beetles on account of the scarcity of food, wander about in search of something to eat, and often attack plants of the tobacco family as *Nicotiana affinis* and the newly introduced *N. Sanderæ*, both of which are favorites in flower beds because of their large foliage and showy flowers. The former is deliciously scented at night. These beetles swarm on to such plants in September and unless attended to at once quickly destroy the foliage and flowers. As soon as they are noticed the plants should be dusted with Paris green mixed with 50 times its weight of common flour, or some other dry diluent. If more convenient the plants may be sprayed with Paris green, using one ounce in every ten gallons of water.

THE MILKWEED DORYPHORA, *Labioderma clivicollis*, Kirby. In Eastern Ontario this bettle is very abundant on the common milkweed, *Asclepias cornuti*. Owing to its beauty, the Pleurisy-root, *Asclepias tuberosa*, is

grown in some of the beds on the Central Experimental Farm, but every year the plants are attacked by this insect. Some seasons the species is very abundant and does a lot of injury. It is most prevalent during the month of August, and the injury is mostly done by the mature beetles. The insect although it is so abundant at Ottawa is, I believe, uncommon in western Ontario.

Homohadena badistriga, Grt. For some years the larvæ of this noctuid moth have been present, in more or less numbers, on several kinds of climbing honeysuckles, (*Lonicera* species) on the Central Experimental Farm. During certain seasons their injuries have been quite apparent. In May, 1901, the larvæ were abundant on many of the yellow-flowered varieties, which they seem to prefer. At this time caterpillars in all stages were found. Very young larvæ, about a quarter of an inch long, were collected, but no trace of eggs or empty shells could be seen. Every year since 1901 we have looked in vain for eggs, although we have found young larvæ which could not have been out of the egg more than a day or two. The young larvæ feed on the buds and foliage of the new shoots of the plant, hiding in the day time inside the two clasping leaves, which surround the cluster of flower buds at the tip. As they mature they crawl down to the shady side of the old wood of the plant upon which they rest when not feeding. When in the last stage the ground colour of the caterpillar is remarkably like that of the stem, or twig, upon which it rests.

THE IRIS BORER, *Macronoctua onusta*, Grt. In the 1903 report of this Society, the writer reported the occurrence, in destructive numbers, of the larvæ of this noctuid moth, which is rare in collections, and gave notes on them and on the pupæ. During the past season the species was again observed in some of the Iris beds on the Central Experimental Farm, but not in destructive numbers. Full grown larvæ were found on July 21. Nothing new was noted with regard to their habits.

THE COLUMBINE BORER, *Papaipema purpurifascia*, G. & R. Mention of an infestation by this insect at Ottawa in 1904, was made by the writer in our last annual report. During the past season this borer was again very destructive at Ottawa to cultivated Aquilegias. On June 29 they were very abundant, boring into the stems. At that date they were 7-8 of an inch in length and only a few had entered the roots. On July 13 as many as 13 larvæ were found in one columbine plant, and every plant in a large bed seemed to be seriously infested. It was interesting to note this year, however, that many of the larvæ were parasitized by a *Tachina*, possibly one-third of the larvæ collected.

THE BURDOCK BORER, *Papaipema cataphracta*, Grt. This is another noctuid borer, but one which, while abundant almost every season at Ottawa, seems to be of rather uncommon occurrence in other parts of Ontario. Unlike the two mentioned above, this larva seems not to mind adapting itself to any plant with a succulent stem, and so has been found infesting a variety of different plants. At Ottawa, the favourite food plant is burdock, and two or three larvæ are often found in the same plant. During the past season the caterpillars were quite abundant at Ottawa, and in about an hour's time, on July 27, Dr. Fletcher and I collected nearly fifty specimens. These with the exception of two were all found in burdock. Other plants in which we have found this borer are Canada Thistle, dahlias, lilies, sunflowers, tomatoes, potatoes and rhubarb.

Unfortunately, owing to the boring habits of these larvæ, there is no remedy for them other than cutting off the portion of the plant containing the caterpillar and destroying the latter. It is seldom, however, that these

insects are sufficiently abundant to be destructive enough to cultivated plants to cause alarm. As a rule it is only a very small number of plants which are attacked. The presence of these borers in gardens can usually be detected by the unhealthy appearance of the plants, the tops in most instances having become withered and fallen down to one side.

THE SPIRÆA LEAF-TYER, *Olethreutes hemidesma*, Zell. In 1901 the leaves of several of the Spiræas in the Arboretum of the Central Experimental Farm, were drawn together at the tips of the plants by beautiful little larvæ about half an inch in length. Specimens of these were collected on June 18 and moths reared, the first one emerging on July 3. These caterpillars were fairly abundant on a few bushes and their feeding places could easily be detected at the tips of the branches. The caterpillar is very dark velvety green, with conspicuous rows of white tubercles on the body, each of which bears a long slender hair. The head is tawny, with a distinct black band on the posterior margin of cheek; ocelli and antennae black. Thoracic shield concolorous with head centrally, but black on most of the lower third. Thoracic feet black. Specimens of the moths were kindly identified by Mr. W. D. Kearfott.

THE ASTER SHARK, *Cucullia convexipennis*, G. & R. At Ottawa the larvæ of this noctuid moth are some years fairly abundant feeding chiefly on the the flowers of China asters. They have never been abundant enough to do very serious injury, as a rule not more than one or two specimens being found on the same plant. Full grown specimens have been found during the latter part of August and in September. The caterpillar is a rather striking one when mature, measuring over an inch and a half in length, with a wide reddish band down the centre of the back, on either side of which are four or five dark brown irregular lines, the colour between being white. The sides are white with transverse bands of brown. Just above the feet is a bright, wide band of red. On the under side are some more irregular lines. The head and front feet are shiny black, the hind feet being dark brown. When present on a plant the larvæ are generally seen lying among the florets, and as a rule are quite conspicuous, although sometimes they are rather difficult to detect on account of their colours resembling those of the flowers. Occasionally we have seen specimens resting on the stems of the plants.

THE MINT SPHINX, *Sphinx eremitus*, Hbn. On several occasions we have found, at Ottawa, the full grown caterpillar of this beautiful hawk-moth, feeding in flower gardens on Monarda and mint. The species is not at all common in Ontario, and collected specimens are always considered good finds. Two dates on which we have found the larvæ are 25th August and 20th September.

THE BORDERED SALLOW, *Pyrrhia umbra*, Hufn. The young larvæ, green spotted with black, of this noctuid have the habit of eating into the buds of *Delphinium*, *Aquilegia* and many other garden flowers. The larvæ are also frequently found late in the year on many low plants, particularly on different species of *Polygonum*. There are two distinct forms of this larva, one being green spotted with black tubercles and having conspicuous dark longitudinal stripes, the other milk-white with a cross-shaped orange blotch in the centre of each segment on dorsum. This latter form also has markings along the body but these are indistinct.

THE BRONZE COPPER, *Chrysophanus thoe*, Bdv. (Fig. 57.) In the Botanic Garden at the Experimental Farm, plants of the genus *Polygonum*, are almost every season, more or less, attacked by the caterpillars of the above butterfly. These infestations are never very serious, but on one or two

occasions the larvæ were rather abundant and noticeable injury to the foliage was done. It is not likely, however, that these caterpillars will ever become sufficiently numerous to require attention. Some of the cultivated Polygonums are familiar in flower gardens and if this insect should be found doing serious injury, Paris green applied to the foliage either in a spray, or a dry diluent, would soon destroy any caterpillars present. Injury to the foliage of such conspicuous plants as these is easily recognized, and further damage can be prevented if prompt action is taken. The ordinary wild food plants are various species of Rumex.

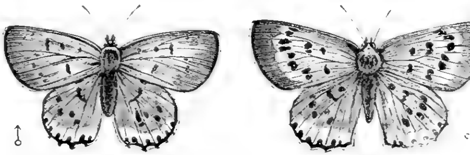

Fig. 57. Chrysophanus thoe; male and female butterflies.

THE SUNFLOWER "PEACOCK FLY," *Straussia longipennis*, Weid. Stems of the common sunflower, *Helianthus annuus*, L., at Ottawa are invariably infested by the maggots of this fly. These insects, or "peacock flies" so-called, because of their habit of elevating the wings and strutting about peacock-like, are very beautiful, the wings of many of the species being prettily marked and spotted with black or brown. At Ottawa the above species has been so abundant some seasons that it has been impossible to find a sunflower plant of which the pith had not been almost entirely devoured. Plants, however, the pith of which had been tunnelled from the base to the very flowers grew remarkably well and kept green and vigorous up to the first frosts. This insect, therefore, does not appear to injure the sunflower to any practical extent. The flies may be found in early summer.

INJURY TO PINKS AND CARNATIONS BY AN ANTHOMYIAN. Occasionally in flower gardens in different parts of Canada, various kinds of pinks and carnations have been injured by Anthomyian larvæ. In Dr. Fletcher's report for 1885 it is stated that injury at Victoria, B. C. was first noticed about the middle of May. Referring to this attack Dr. Fletcher says: "The egg appears to be laid at or near the base of the topmost leaves. The young maggot burrows beneath the epidermis of the base of the leaves for some time and then bores down the centre of the stem." Specimens of this Anthomyian were bred at Victoria by Mr. J. J. Cowley. The maggots left the plants about 1st June and went into the ground to pupate. The flies appeared about 10 days later. During the same year Dr. Fletcher found a specimen at Ottawa which was destroying Indian Pinks in exactly the same manner as those in Mr. Cowley's garden. This specimen produced a fly which Dr. Fletcher says, was apparently identical with those bred at Victoria by Mr. Cowley. Since then the species has been found to be rather destructive to the shoots of the pretty perennial *Gypsophila paniculata*, which also belongs to the Pink family.

THE VARIEGATED FRITILLARY, *Euptoieta claudia*, Cramer, (Fig. 9.) In July last an enquiry was received at the Division, concerning a caterpillar which was destroying pansies at Baltimore, Ont. The correspondent, Mr. T. M. Wood, writing to Dr. Fletcher, July 18 said: "I send herewith two caterpillars which I found on a row of pansies. About a week ago there

were dozens of them but to-day I got but five, which I put in a box with a pansy plant. I see to-night they are changing to the pupa state." The specimens arrived at Ottawa on July 20 and proved to be *Euptoieta claudia*, Cramer. The occurrence of the species in numbers, at Baltimore, Ont., is very interesting, as the insect is rare in Ontario, only a few previous records of the butterfly having been recorded by collectors. In the North-west the butterfly is much more abundant, and was found, by Dr. Fletcher, very destructive to pansy beds at Kinistino, N. W. T. Dr. Fletcher tells me he has seen the females ovipositing on the wild flax, *Linum sulcatum*.

Sparganothis (*Œnectra*) *flavibasana*, Fern. In June, 1895, this species was found in some numbers by Mr. J. A. Balkwill, at London, Ont., and specimens of the moth were identified, through our late Curator, Mr. J. Alston Moffat, by Prof. C. H. Fernald. Mr. Balkwill found his first specimens at rest upon honey-suckle in his garden, but later found some pupæ which produced the moths. In the *Canadian Entomologist*, October, 1895, Mr. Moffat says: "Presumably the larvæ had fed upon the honeysuckle, as chrysalids were found in the connate leaves with a thin silken web spun over them, one of which I raised to the moth. There is plenty of evidence of feeding having been done upon the plant, but nothing positive as to what did it. A lookout is being kept upon the plants for the next brood." Under date of November 17, 1905, Mr. Balkwill writes: "Your letter of the 15th inst. is to hand. I am sorry that I am unable to give you the information desired. I captured the moths on honeysuckle and found some of their cocoons, which were reared to mature insects. We could not find the larvæ although Mr. Rennie and I kept a good look out for the next two years."

The Greenhouse Leaf-Tyer, *Phlyctænia rubigalis*, Gn. = *Phlyctænia ferrugalis*, Hbn. In Canada this insect has never been reported as doing any injury to plants other than those grown under glass. In the United States, however, the caterpillars are known to feed on several kinds of crop plants, as celery, cabbage, beets and tobacco, as well as on a great many ornamental plants grown outside, such as wall-flowers, dahlias, daisies, begonias, roses, nasturtiums, geraniums, carnations, etc. The insect is abundant in some of the large greenhouses in central and western Ontario and mention has been made of injuries by the larvæ in Toronto, in the annual reports of the Dominion Entomologist for 1899 and 1900. Since that date Dr. Fletcher and the writer have published the life-history of the species in the May, 1901, number of the *Canadian Entomologist*. When full grown the caterpillar is about three-quarters of an inch in length, of a semi-translucent green colour, with two distinct black spots (one on each side) close behind the head, and a green dorsal vessel showing distinctly down the middle of the back, bordered on each side with a double white band. As its popular name would suggest the caterpillar has the habit of drawing together portions of a leaf, or of two leaves that happen to be contiguous, and tying them with fine threads of silk. This webbing of the leaves is more apparent, of course, as the larva reaches maturity, and owing to its manner of protecting itself it is rather difficult to reach with a spraying mixture. A Paris green or some other arsenical mixture would doubtless prove to be a remedy, should the caterpillars be noticed working on any plants in flower gardens, or many of them could be removed by handpicking.

Rose Root-Gall, *Rhodites radicum*, O. S. (Fig. 58.) This large gall which is from 1½ to 2 inches in diameter is not infrequently found in Ontario on and at the roots of many kinds of wild roses, as well as sometimes on cultivated ones. The insect which causes this conspicuous gall is a four-winged

fly, with a short round reddish body, belonging to the hymenoptera. At Ottawa we have found these galls irregular, smooth and potato-like rather oftener than elongated as shown in the figure. The only suggestion in the way of a remedy is to cut out the infested portions of the plants.

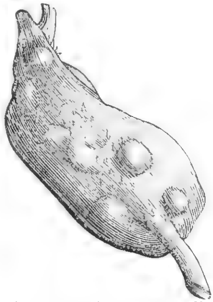

Fig. 58. Rose Root-gall.

Tortrix albicomana, Clem. The small caterpillars of this well known little Tortrix moth were very abundant and destructive to the leaves of Japanese Rose at Ottawa during the past summer. They were particularly abundant about the middle of June and moths were flying in large numbers around the bushes on July 8, on which date Dr. Fletcher collected many specimens.

Archips purpurana, Clem. Several specimens of the larva of this common, rather small, moth, were found at Ottawa by Dr. Fletcher during the past season in his cultivated beds of wild violets. No serious injury was done to the plants and the specimens when discovered were removed by hand.

THE HOARY PLUME, *Pterophorus monodactylus*, L. During the past season at Ottawa the small green caterpillars, much the same colour as the leaves of their food plant, of this plume moth were found to be very destructive to the Minor Convolvulus. These larvæ which were most abundant in September were found to be eating the flower buds and leaves at the tips, entirely preventing the plants from developing any flowers. Associated also with this species was the tineid *Bedellia somnulentella*, Zell, which helped to some extent in the injury.

LEAF MINER IN LEAVES OF LONICERA. During some seasons at Ottawa the leaves of one of the honeysuckles, *Lonicera fulgens*, have been mined by a small lepidopterous larva, which in 1901 we reared to the perfect state, and which has been identified by Mr. August Busck of the U. S. Bureau of Entomology, as *Lithocolletes fragilella*, F. & B. The larva makes a conspicuous blotch-like mine in the leaves, and on some foliage examined there were two or three mines in the same leaf. In 1901 the larvæ were first noticed about July 20 and by August 5 had pupated.

FOREST ENTOMOLOGY.

By E. J. Zavitz, Ontario Agricultural College, Guelph.

Destruction of the forest by insects is a problem in which the forester is very much interested. The depredations of these small foes are being carried on to a greater extent than we realize, and every season sees large quantities of timber being injured or destroyed by insects.

Entomology is of vast importance to the forester, and he should at least become acquainted with the appearance and life history of the important forest insects. In universities and forest academies in Germany where forestry is taught, special courses are given in Forest Entomology. The German forester carries in his pocket a small calendar in which he takes notes and in which is recorded what to look for during each month of the year. It is interesting to note that one of the subjects, taking greatest space, is that regarding the insects for which to be on the lookout during each month.

Insects damage forests in many ways and at various stages. The fruit, the tender seedling, and the roots, foliage and wood of the mature tree all have their enemies. In fact, during its whole life history the tree is subject to attacks.

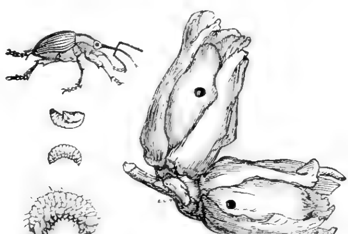

Fig. 59. Balaninus beetle, grub, pupa and infested nuts.

In collecting the acorns of Red Oak for seed I have found that a large percentage of the acorns are destroyed by one of the Curculionidæ. Two bags of acorns, which had been allowed to stand over night, were surrounded by footless grubs one centimetre in length. These are probably the larvæ of *Balaninus quercus*. It was estimated that about forty per cent. of these acorns were destroyed by this insect. The female insect bores a hole into the acorn and then drops in the egg which develops into the grub-like larva. This larva feeds upon and in most cases destroys the acorn. After the acorn falls to the ground in autumn the larvæ go into the soil and transform, coming forth the following spring. (Fig. 59 represents a closely allied species which attacks Filberts).

This shows that this insect alone is a strong factor against the reproduction of red oak under natural conditions. Curculios also infest the seed of such trees as basswood, hickory and chestnut.

During the seedling stages of the tree the insects carry on their work. The cutworm has given some trouble in cutting the white pine seedlings in the nursery beds. A number of small white ash were found to be dying, and upon examination it was found that the roots were attacked by the wireworm or larvæ of the click-beetle. The larvæ were hardly discernible at first

as they had gone into, and were working in, the centre of the root. Damage was also done to the roots of some seedlings by the Lachnosterna larvæ. (See Fig. 6.) I regret that I am unable to identify the above species. However, I expect they will give me sufficient opportunity to further study them. The foliage of forest trees suffers from the work of a great variety of insects. This injury is not only unsightly but from the forester's standpoint hinders the proper development of the stem of the tree. Defoliation cuts off the food supply and so lessens the amount of wood laid on during the season. Considerable damage is annually being done by Lepidopterous larvæ. Owing to the fact that their life history is more easily followed than that of other orders there is considerable known and written concerning their work.

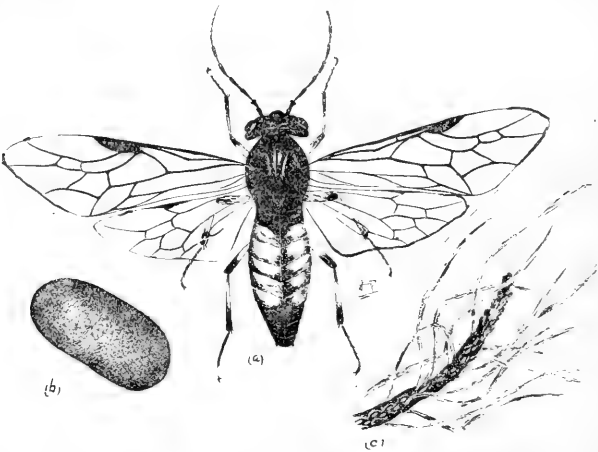

Fig. 60. Larch Saw fly; *a*, with outspread wings; *b*, the brown pupa case—both greatly enlarged; *c*, terminal twig of Larch showing eggs in slits made by the female saw fly.

The Larch Saw-fly, (Fig. 60), a hymenopterous leaf destroyer, has done an enormous amount of damage in Canada. The tamarac has suffered from this insect throughout its known area of distribution and as yet its natural enemies have not controlled it. In the vicinity of Guelph this insect has done considerable damage to the European larch and our native tamarac during the last season.

Coleoptera, in both the larval and adult form, are responsible for damage done to the foliage. The Lamellicorns and Chrysomelids both feed upon the leaf in the adult form. Lachnosterna frequently does damage to the maple and other leaves, but not to any serious extent. The basswood or linden leaf seems to suffer most from their attacks and late in the summer it is almost impossible to find a perfect leaf. Large numbers of *Macrodactylus subspinosus* (Fig. 30) and *Odontota rubra* have been taken from this tree in beating operations and probably they are responsible for a great share of the damage done. Of the Coleoptera the Chrysomelids in the larval and adult stages do most damage to the leaves of forest trees.

Roots are attacked by the larvæ of Prionids and Lamellicorns. Buds have enemies in the Curculionidæ and Lepidoptera. Deformities on terminal branches are formed by Aphidæ, Cynipidæ and Cerambycidæ.

The direct injury done to the stem or timber part of the tree affects the forester most seriously. One of the Cossidæ or Carpenter moths, *Prionoxystus robiniæ,* was taken emerging from the sugar maple in the vicinity of Ridgeway, Ontario. The work of this Cossus moth was noticed in several trees in the same vicinity. These same maples are infested with one of the Siricidæ which I take to be *Tremex columba.* (Fig. 28.)

In the College nursery some Austrian pines about three feet high showed signs of dying in August. Upon examination it was found that the stems in some places were completely girdled beneath the bark. This work was being done by one of the Curculionidæ, *Pissodes strobi,* (Fig. 61), described in Bulletin 22, Division of Forestry. In July the leaves of these pines began to droop and by August they had turned quite brown. In the second week of October I took a number of mature insects from their little cells beneath the bark. Upon a further examination about the first of November I found they had left this retreat for hibernation in other quarters.

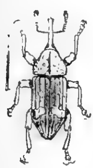

Fig. 61. Pissodes strobi, Pine-Curculio.

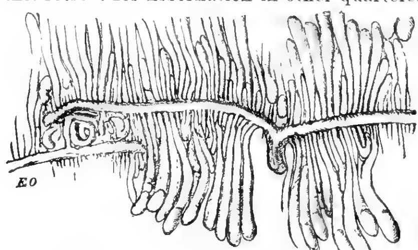

Fig. 62. Tunnels of Scolytus beetle.

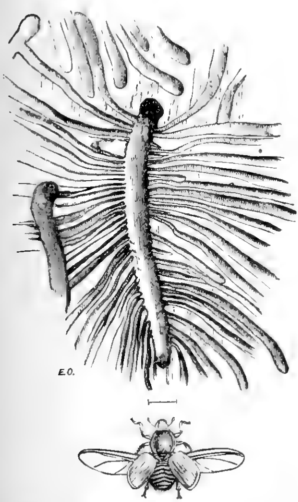

Fig. 63. Scolytus beetle and its tunnels.

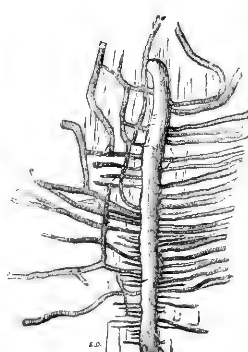

Fig. 64. Tunnels of Scolytus beetle.

Fig. 65. Buprestis borer.

However, the insects which do the most serious technical injury to trees are the Scolytidæ, Buprestidæ and Cerambycidæ. These insects by boring either in the cambium layer, sapwood or heartwood of the tree leave channels which greatly lessen the commercial value of the tree. They attack the living tree in the forest, the log at the drive or mill, and the lumber in the yard.

The Scolytidæ work in the bark, cambium layer and sapwood (Figs. 62, 63 and 64) and this family is one most to be dreaded by the forester. Large areas of forests have been destroyed by members of this family. It would be impossible to estimate the value of timber destroyed by the pine bark beetle, *Dendroctonus frontalis.* Its distribution seems to cover the whole coniferous region east of the Rocky Mountains. An unidentified species of Scolytidæ has been doing some damage this season in the nursery to Scotch pine. The beetle is about two mm. long and has completely undermined the bark.

Buprestidæ (Fig. 65) and Cerambycidæ (Figs. 66 and 67) injure the stems of the tree in much the same manner. In some cases they make channels throughout the stem although some species work only beneath bark and in the sapwood.

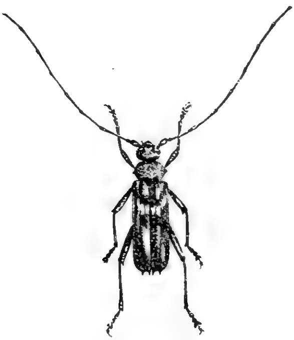

Fig. 66. Cerambycid beetle (wood-borer).

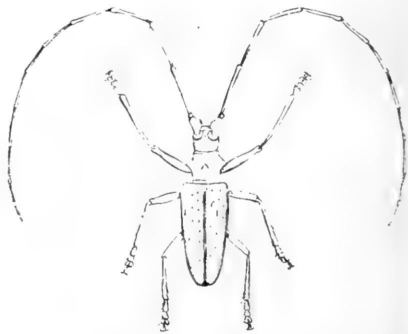

Fig. 67. Cerambycid Pine-borer.

The stems of second growth hickory (*Hicoria ovata*) in the vicinity of Ridgeway have been badly infested with the larvæ of *Goes pulchra.* The same trees are also attacked by *Dorcaschema nigrum* which girdles the terminal branches. Even after the tree leaves the forester's care it is liable to insect attacks. Upon examination of some hickory lumber, which had been piled so that the boards were in close contact, I found *Phymatodes variabilis* doing great damage. Thus throughout the whole history of the tree it is subject to insect injury and the amateur entomologist feels that the species to be studied are almost infinite in number.

From the systematic collector's efforts probably a large percentage of our forest insects in the adult form are now in collections throughout the country. However, this is a subject of economic importance, the forest being one of our greatest resources. Very little is known concerning the life history of our forest insects and only by research can the required knowledge be obtained. There is a wide field for the study of forest insects in relation to plant host, parasites or other enemies. Future protection can only be had in so far as we have men specially trained who recognize and understand the movements of these tiny foes.

PHLOX MITE—TETRANYCHUS BIMACULATUS.

By T. D. Jarvis, Ontario Agricultural College, Guelph.

This species of mite, for several years past, has caused injury to the cultivated perennial Phlox on the College Campus. It answers to the description of the "Red Spider". The leaves become spotted above and the under surface is coated with a fine loose web containing many minute particles. The small red oval mites may be seen with the naked eye and they vary from a few to as many as fifty or more on the under surface of a single leaf. (Fig. 68.)

Length of mite .433 m.m.; width .241 m.m.

Length of front legs, .241 m.m.; length of mandibles, .016.

Length of cephalo-thorax, .040 m.m.; length of hairs on legs, .100 m.m.

The legs of the mites are slightly orange or yellowish in color and six jointed.

The mites hibernate on the lower leaves of the plant. Up to the 20th of May the mite may be found feeding on the basal leaves of the plant.

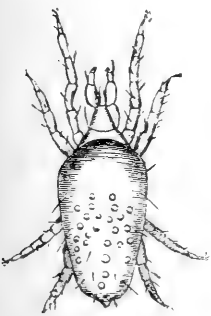

Fig. 68. "Red Spider," greatly magnified.

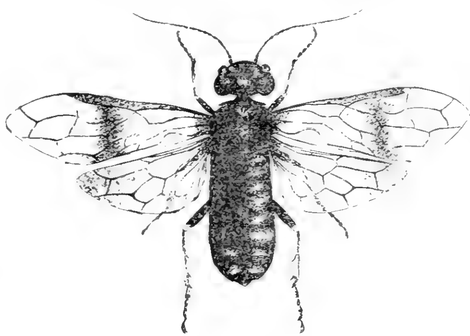

Fig. 69. Spruce Saw fly—greatly magnified.

BLUE-SPRUCE SAW FLY—LYDA SP.

By T. D. Jarvis, Ontario Agricultural College, Guelph.

This Sawfly has caused injury to the Colorado Blue Spruce, *Picea pungens,* on the College Campus at Guelph. It has not been found on any other species of spruce on the Campus.

The excrement of the larvæ lies in masses on the leaves and branches, and in some cases the tree becomes very unsightly. The larvæ are found in small colonies of from three to ten feeding beneath the masses of excrement. They cut off the leaves and carry them to their retreat under the excrement.

The larvæ (Fig. 70) are green and when full grown are 26 m.m. long and the antennæ 1½ m.m. long. The head and prothroax are black. The

hair-like appendage on posterior segment of abdomen $1\frac{1}{2}$ m.m. long. The abdomen contains 11 segments.

When mature the larvæ drop to the ground and make a little cell about 3 inches below the surface of the sod. They pass the winter as larvæ and pupate in the spring.

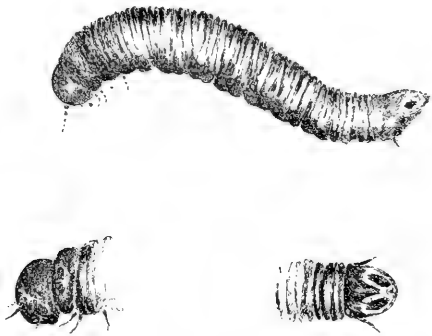

Fig. 70. Spruce Sawfly larva; head and anal segments—greatly enlarged.

The adult Sawflies (Fig. 69) appear about the 20th of May. They spend only a few hours depositing their eggs and then disappear. The sawfly is a large, black, shiny insect, about 14 m.m. long. The mandibles and a part of the face is yellow, the rest of the body is black. The thorax is feebly punctured. The antennæ are about 9 m.m. long and 32 jointed. The upper wings are mostly clear, while the lower wings are clear above and dusky toward the outer margin.

BUMBLE-BEES THAT FERTILIZE THE RED CLOVER.

By T. D. Jarvis, Ontario Agricultural College, Guelph.

In the month of June Mr. C. C. James, Deputy Minister of Agriculture, mailed to our department a letter which he had received from the New Zealand Government, enquiring for information on the species of Bombus that fertilizes the red clover in Ontario so that they might find out what species is most useful in clover fertilization.

The following is a copy of the letter received from Mr. O. B. Pemberton, Secretary of the Canterbury Agricultural and Pastoral Association, Christchurch, New Zealand, 26 May, 1905.

The Secretary of Agriculture.

Sir,—I take the liberty of writing to you on behalf of this Association regarding the fertilization of Red Clover in Canada.

A Committee of this Association has been appointed to enquire into the fertilization of red clover in other countries with the view of the introduction of the bees most suitable as fertilizing agents.

Before the introduction of the humblebee into New Zealand from England in 1855, the yield of red clover seed was not sufficient to be commercially payable. Since the introduction, however, the yields have been more prolific, but it is still thought that the best results have not yet been obtained.

We have in New Zealand, as far as we know, three kinds of humblebees, the descendants of those imported in 1885, viz., *Bombus terrestris, Bombus hortorum,* and *Bombus hortorum* variety *Harrisellus. Bombus terrestris* is the most numerous and is, I believe, considered quite unsuitable on account of the shortness of its proboscis.

My Association would deem it a great favor if you could forward me any information you may have gathered as to what bees or insects you have in Canada most suitable for the fertilization of the red clover.

Forty-eight specimens of bumblebees were collected from the flowers of the red clover. The specimens were sent to Dr. McGillivray, Cornell University, and identified. Three species were found—*Bombus fervidus, Bombus ternarius* and *Bombus borealis.*

Dr. Brodie, of Toronto Normal School, reports *Bombus consimilis* as being one of the more common species around Toronto.

Dr. Fletcher stated that *Bombus fervidus* is the most common species at Ottawa, while *B. borealis* is rare.

INJURIOUS INSECTS OF 1905 IN ONTARIO.

By W. Lochhead, Ontario Agricultural College, Guelph.

The number of injurious insects in the season of 1905 was about the normal, but the amount of damage done to crops of all kinds was perhaps below the normal,—there being no outstanding case of very serious loss.

The *Pea-weevil* no longer gives anxiety to the growers of peas, but in this apparent security from this pest lies the danger for the future. The farmer just now is able to give practically a death-blow to pea-weevils for many a year if he would insist on sowing only peas that have been fumigated with carbon bisulphide. It is an easy task to conquer and control an enemy when it is weak; and this is the present condition of the pea-weevil. If this precaution of using fumigated seed is not taken, the weevils will increase every year until they are beyond control.

A species of Joint-worm, (see Fig. 29), probably *Isosoma hordei*, was present in a few localities on wheat and barley, but did very little damage. It produces galls at, usually, the second joint of the stems, which are consequently deformed and weakened. Within the galls are the minute yellowish-white maggots with blackish jaws. The larvæ usually remain over winter within the galls, and the adults, small black four-winged flies, emerge in the spring. Fortunately there is only one brood each year.

It is doubtful if this Joint-worm will ever become a serious enemy in Ontario, where the majority of farmers practise a system of regular rotation of crops, and where the roadside and fence corner grasses are cut at the time of haying.

The Horn-Fly (Hæmatobia serrata), was more prevalent over the Province this past season than it has been for several seasons. Although this insect is now well known by nearly all farmers, yet it is remarkable how few stock-owners apply the simple treatments that have been advocated for years by the practical entomologists. This fly, it is well known, is one of the most annoying and troublesome pests of cattle in summer, and young cattle in good pasture are frequently annoyed to such an extent that they lose rather than gain flesh. Milch cows, too suffer much from these flies, and the supply of milk is always very much reduced in quantity during the "fly" season.

The life-history of the Horn-fly is well known. The eggs are deposited in fresh cow droppings, where the maggots develop and the pupæ form.

There are many broods during the season, so that their increase is very rapid. The adult flies are smaller than the house-flies. They congregate in masses about the base of the horns, on the flanks, and on the belly, just outside the reach of the tail or head of the afflicted animal.

For several years it has been observed that oils or greases rubbed on the affected parts will give relief for several days, and the flies will not come near. Fish oil is strongly recommended and has been used by many owners of stock. The addition of crude carbolic acid in the proportion of one tablespoonful to one quart of fish oil increases its effectiveness.

This past summer I had an opportunity of testing the effectiveness of kerosene emulsion solution against the Horn-fly. The emulsion is readily made and in the usual way, and was applied by means of a small hand spray pump. A fine nozzle was employed so that a very fine mist was obtained. I found that although the emulsion gave almost immediate relief and killed enormous quantities of flies that collected in the stable, yet it was necessary to repeat the operation during the worst portion of the season, both night and morning.

Unless I was present, the spraying operation was usually neglected, and the flies became as numerous as ever. It became apparent to me that if the stable employees about a large stock farm found it difficult to apply this kerosene emulsion sufficiently often to keep the flies away, we need not expect to have any better results in the ordinary farm stables where stock is probably not as well cared for.

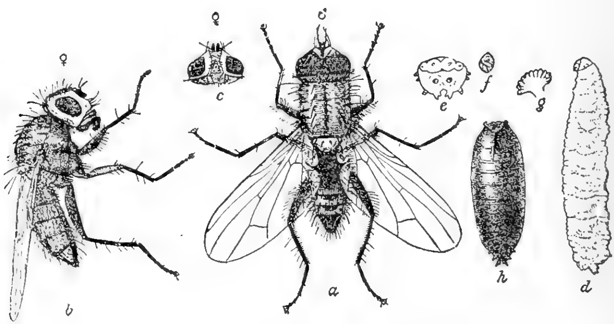

Fig. 71. The Seed-corn Maggot; *a*, *b*, flies; *d*, maggot; *h*, puparium—all very much enlarged. (After Chittenden, U.S. Dept. Agriculture).

In the dairy stables of the Ontario Agricultural College Zenoleum was used. It was applied with a compressed air sprayer. As it is readily made, the same objections cannot be found with regard to its preparation as against the preparation of the kerosene emulsion. The herd was kept free from the horn-fly with but two or three applications per week, and the herdsman is enthusiastic concerning the merits of this preparation.

Again, the use of the compressed air sprayer makes the operation a very simple one, and with the general introduction of such sprayers, we may hope to have less fear for the Horn-fly in the future.

Garden Insects.

The Seed-Corn Maggot (Phorbia fusciceps, Zett), Fig. 71. The work of this maggot on planted corn seed was brought to our attention about the third week in June, at St. Anne de Bellevue on the Island of Montreal. In a field recently planted many of the seeds sprouted very slowly, while others failed to sprout at all. On examination of the planted seeds many of them showed the presence of the Seed-corn Maggot. From the seeds that had not sprouted the maggots had hollowed out large cavities and had destroyed the embryos. In other seeds the cavities were smaller, and sometimes the embryo had escaped injury, with the result, however, that the germs were weak and made but little growth.

The seeds were planted at a time when the soil was cold and damp and for over a week the weather remained cold and wet, with the result that incipient decay set in, and the adult flies were attracted to the decomposed matter as a suitable place for oviposition.

It may be stated here that the stand of corn was a large one in spite of the number of injured seeds. After a dressing of soda nitrate had been given to the land, the crop developed well with returning warm weather, and a fine yield was obtained at the close of the year.

In 1900 I called attention to a destructive outbreak of similar maggots on beans in Lambton County. It is probable that the maggots in this case belong to the same species as those observed at St. Anne's.

The life-history of this insect is not well known. The adult is a two-winged fly about the size of a small housefly. Dr. Chittenden of Washington says it can best be identified by the male, which possesses a row of short, rigid, bristly hairs on the inner side of the posterior tibiæ.

The Seed-Corn Maggot is smaller than the Onion Maggot, being about ¼ of an inch in length. Dr. Chittenden says: "In the Northern States it is probable that we have at least two generations, the first injurious in May and June to such seedlings as are then to be found, and the second generation feeding upon weeds or dead or dying plants, in excrement and in refuse without their presence being manifested.

It has been surmised that the species agrees with others of its kind in passing the winter in the adult condition, although it is possible also that it hibernates in some localities at least as a puparium."

Professor Garman of the Kentucky Agricultural Experiment Station reports that this insect attacks young cabbage plants, in early spring, and hemp plants which are often destroyed over large areas. "The maggots work in the stems, but leave the plants, when ready to pupate, and enter the earth for a short distance, changing to yellow pupae .18 inch long and about .06 inch in diameter. Besides hemp and cabbage the insect is known as an enemy of planted seed corn, of radishes, onions, and of the common weed, hedge-mustard." Professor Garman calls this insect the *Fringed Anthomyian*, and places it in the Genus Pegomya.

The Tarnished Plant bug (*Lygus pratensis*). Many reports reached us throughout the season regarding the injuries done by this insect to cultivated plants of both the garden and orchard. In the garden it was specially injurious, for it pierced and deformed buds and terminal shoots of cabbage, cucumber, and potato, and sucked their juices. Flower gardens and plantations of small fruits suffered also, and reports came in of the blighting of strawberry blossoms and young berries, and of the blackening and shriveling of the currants. Besides, these insects attack many weeds and other wild plants. The insects are more numerous, and hence more readily notice-

able by the public, in late summer, but most of their injuries are done in early summer.

The Tarnished Plant Bug (Fig. 72), is one of the true bugs, and obtains its food by piercing the tissues with its beak and sucking the juices. The adult insects are about 1-5 of an inch long, and are very variable in color, ranging from a dark brown through light brown to yellowish or yellowish-green. The broad region behind the head (prothorax) is bordered with yellow, and has four or five longitudinal yellowish lines; the triangular area behind the prothorax bears also a yellow V, and the upper wings are marked with dark and light spots.

The adults winter over under rubbish, and are ready in the early spring to attack the young buds and fruits. Their eggs are deposited on the food plants, and in a few days the young larvæ or nymphs appear. All through the season nymphs and adults may be found feeding together. The nymphs moult four or five times, gradually becoming more like the winged adults. There are probably only two broods in Ontario.

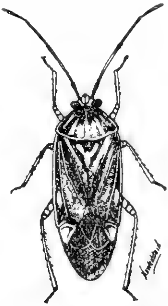

Fig. 72. The Tarnished Plant-bug—much enlarged.

On account of the fact that Tarnished Plant Bugs have a wide range of food plants, hence are widely distributed, and occur at all times of the season in every stage of development, treatment is difficult. The following remedies have been found somewhat effective and are here recommended:

1. The use of pyrethrum or insect powder. This should be mixed with four or five times its weight of flour and dusted on such plants as strawberries, garden flowers, cucumbers, potatoes, &c., in early morning while the insects are torpid and the dew is on the foliage.

2. The bugs may be readily shaken from infested trees and shrubs in early morning upon a sheet, and destroyed.

3. The application of a kerosene-emulsion spray or some good tobacco solution in early morning will destroy large numbers of the bugs, and help to keep them in check.

Root Maggots belonging to different species of insects attack the roots of cabbages, onions, and radishes, and do a great deal of injury. These along with the white grubs and wireworms are the *bêtes noires* of truck-gardeners. No satisfactory remedies have as yet been discovered for their control, and great losses are sustained every year through lack of information and treatment.

We are, however, specially indebted to Professors M. V. Slingerland and S. A. Forbes for their valuable investigations into the life-histories of

these troublesome root insects, and for their experimental studies of remedial treatments. It is now fairly well known that many of the so-called remedies are utterly worthless.

The most common root maggots that are found affecting vegetables are the Cabbage or Radish Root maggot, and the Onion Maggot. The adults of these are small flies. These lay their eggs on the stems of the plants near the ground and the maggots on hatching make their way down the stem and begin burrowing into the roots. It is a common thing to find the surface of the roots of young radishes completely mined by maggots. When full grown these maggots form brown puparia in the soil. The cabbage or radish maggot does its chief harm in June and July, as the young radishes are coming up and after the young cabbages are transplanted.

With regard to remedies, it may be repeated that no perfectly effective remedy has been found for the cabbage root maggot, but the following remedies are valuable in controlling their depredations to some extent:

(1) Cheese cloth covers. In the large truck gardens of Long Island and New York, many of the growers resort successfully to the use of enclosures made of cheese cloth, arranged about light wooden frames. These may be made of any size, and can be removed at time of cultivation. If such frames are kept over the young plants for about six weeks, injury from these maggots may be completely prevented, since the fly is not able to deposit her eggs on the plants.

(2) Tarred paper disks. These were advocated by Prof. Slingerland, but the great objection to such a procedure is the trouble required to place the disks on the plants, and most growers of cabbages prefer to lose their plants rather than take this extra trouble.

(3) Hellebore or Insect Powder. Both of these insecticides have been used to great advantage. Dr. Forbes says "about one-half tea cupful of a decoction of pyrethrum powder, four ounces to a gallon of water, or white hellebore of the same strength, poured around the root of each plant after drawing away the earth right down to the roots, will destroy any maggots which may have started work. The earth should be put back again and the plants hilled up, when new rootlets will soon be formed. A light sprinkling of nitrate of soda will encourage a quick growth and help the plants to overcome attack."

For radishes white hellebore used as a powder and dusted along the rows once a week has given good results; and a carbolic wash prepared originally by Prof. Cook by dissolving one pound of hard soap in a gallon of water and one-half pint of crude carbolic acid added, then the whole is boiled together for a few minutes to make a stock solution, which should be diluted fifty times with water when required for use. This solution should be sprayed upon the plants once a week from the time they appear above the ground until ready for use.

White Grubs. These are the well known larvæ of June Beetles. The adult beetles deposit their eggs just below the surface of the ground and the grubs hatching feed on the roots of plants for from two to three years. In Bulletin 44 of the Illinois Agricultural Experimental Station, Dr. S. A. Forbes states that the grubs do not change to pupae until June and July of the third season,—the perfect beetles transforming in September but not emerging until the next spring. White Grubs are often very abundant and injurious in garden plots, but a good rotation of crops will do more than anything else to control these insects. Dr. Forbes claims that as the white grubs have an opportunity to develop only in sod land and do not seem to relish the roots of clover plants, it would be well to bring strawberries or

corn late into the rotation. He recommends a short rotation in which rye is sown on the broken-up sod, then seeding to clover the following spring, followed by the small grains, and this followed again by corn or potatoes. If such a method, or a similar one, be adopted in gardens, very few complaints would be heard regarding attacks of white grubs. When white grubs are known to infest lawns, kerosene emulsion may be applied with advantage, if followed by copious watering.

Fruit Insects.

The Peach-Tree Borer, (*Sanninoidea exitiosa* Say (Fig. 73) is quite prevalent in many of the Niagara peach orchards, as the brown gummy masses about the bases of the trees testify. These exudations are composed of a mixture of earth, larval excrement, and borings, and sometimes they extend entirely around the tree. The borer is the grub-like caterpillar of a beautiful moth, and works in the inner bark of the lower trunk or a large root, excavating a tunnel.

The life-history is not yet well enough known to the peach growers. The moths appear from July to September, and the females deposit their eggs on

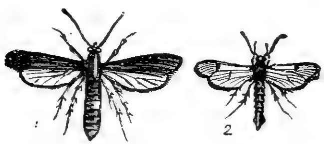

Fig. 73. Peach-tree Borer; 1, female moth; 2 male moth.

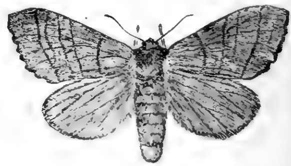

Fig. 74. Datana moth.

the bark of the trunk near the ground soon after their emergence. The larva hatches in a week or so and begins to bore into the trunk, feeding and forming its burrow until winter sets in, when it hibernates. In May the larva begins again to feed, and reaches full size in June or early July. It leaves its burrow then, and forms a dirty brown cocoon at the base of the tree. As a pupa within this cocoon, it remains about three or four weeks, when the moth emerges.

The old-fashioned method of "digging out" or "worming" the borer is perhaps the best that has been devised. The best time to do this work is in spring and fall, and it must be thoroughly done on all the trees.

The practice of "mounding" the trees in early summer is frequently recommended, as it compels the deposition of the eggs some distance above the ground, and the chances are that the birds and predaceous insects devour the young larva before it has a chance to bore into the trunk.

Wrapping the trunk with tarred paper in July and washing the trunk twice with a thick wash composed of "two quarts of strong soap, a half pint of crude carbolic acid in a pail of water with enough of lime and clay to make a thin paste," are methods often used by fruit-growers with considerable success. These methods will give best results if they are made auxiliary to the worming process.

The San Jose Scale (*Aspidiotus perniciosus* Comst), has extended its area considerably during the year, not only in the Niagara district but also in the south western part comprising the counties of Kent and Essex. In the latter region little or nothing is being done by the owners of the trees to control the scale, so that its spread has been very rapid.

In the Niagara district there are now areas thoroughly infested which the inspectors three years ago reported "clean." The number of dead and dying orchard trees is becoming larger every year, and many fruit-growers have had to go out of business because they would not spray.

In another article in this Report I give an account of some experiments which Mr. P. W. Hodgetts and myself conducted to determine the efficiency of the newer scale remedies.

The Codling Worm (*Carpocapsa pomonella*) was perhaps not so destructive this year as usual to apples. The Fruit Marks' Act is in many instances compelling apple-growers to spray their trees, for XXX or No. 1 fruit must be practically free from worm and scab.

The Rose Chafer (*Macrodactylus subspinosus*) (Fig. 30) appeared in large numbers in one or two peach orchards along the lake shore in the Niagara district. This insect is a brownish, long-legged beetle, and breeds in sandy, undrained meadow land. The eggs are laid in the ground and the grubs feed on the roots of grasses. By autumn they reach full growth; in spring they pupate and the adults emerge in June or July. Sometimes these beetles fly in hordes to adjacent vineyards and peach orchards, where they devour the foliage and eat holes in the young peaches. Under such conditions little can be done for arsenicals do not seem to have much effect in diminishing their numbers. Usually they disappear as suddenly as they came. The only remedy to prevent future recurrences of these beetles is to break up and cultivate the meadow land, their breeding places.

The Apple Maggot (*Trypeta pomonella*) is a serious enemy of apples in the eastern part of the Province and Quebec. Its work is readily recognized, as the maggot tunnels the pulp of the apple in all directions, thus rendering it worthless. The adults of these maggots are two-winged flies. They make their appearance in early summer and deposit their eggs through the skin of the apple. The maggots on reaching maturity crawl out of the apple, and transform to pupae in the ground, where they remain all winter.

Spraying as a treatment for this insect is of little or no value. The fallen apples and those infested with maggots should be fed to hogs; in fact, where these maggots are present every year, the hogs should have free run of the orchard.

Grape-Berry Moth (*Polychrosis viteana*, Clemens). (Fig. 34). While engaged in carrying on spraying experiments in vineyards in the Niagara district this season, we found many cases of grapes which were infested with a small dark caterpillar. This caterpillar was quite abundant in some vineyards and was evidently doing much harm. We were not able to work out the life-history of this insect on account of the limited time at our disposal, but we glean the following information from Bulletin 231, "The Grape-Berry Moth," by Prof. Slingerland of the Cornell Agricultural Experiment Station, November, 1904.

The winter is passed in the pupa state in the cocoon, which is most commonly observed on damp and decaying leaves near the ground under the vines. About the first of June the moths escape and deposit their eggs, probably on the stems of the blossom clusters. The early caterpillars begin feeding before the grape blossoms are fully opened, and they often destroy the bud blossoms. Throughout the blooming period the caterpillars continue to work and destroy many of the young developing fruits. This first, or spring, brood of caterpillars feed on the outside of the blossoms and berries, and are thus readily treated with poisons. By July the first most of the caterpillars have reached full size and soon make their peculiar cocoons out of leaves fastened together by silk threads, and lined on the inside with white

silk. Within three or four days, the caterpillar, after forming its cocoon, transforms into a pupa, and a couple of weeks later the moth begins to emerge. Eggs are again laid for a second brood, and this summer brood of caterpillars works during the latter half of July and August. The eggs of the summer brood are laid on the skin of the green berries or on the stems. The most injury is done by this second brood of caterpillars, since in Ontario vineyards the number of the second brood is very large. Many of this summer brood become full grown in August and form their characteristic cocoons and develop moths by the first of September. Some, however, hibernate as pupae, so that there is only a partial third brood in the autumn. Some of the caterpillars of the third brood are full grown before October the first, and transform to pupae within the berries, but most of them make their characteristic cocoons on the leaves like the earlier broods.

Prof. Slingerland recommends the following treatments for the Grape-Berry Moth:

(1) The destruction of fallen leaves. As has been stated, the cocoons winter over on the leaves near or on the surface of the ground. It is evident that the gathering and burning of fallen leaves will destroy the great majority of the cocoons. He also advocates early cultivation, especially the land along the trellis under the vines, in which case many of the hibernating pupæ will be buried and destroyed.

(2) The bagging of clusters of grapes, by putting paper bags around the clusters soon after they have set. This is practicable only to a limited extent, but many grape-growers find that it pays to bag many of their choice grape clusters.

(3) The picking of infested berries in August. It is a comparatively easy matter to detect grapes infested with the Grape-Berry Moth caterpillar, and when such berries are picked and destroyed, much injury can be averted and the surrounding grapes can be saved.

(4) The application of arsenical poison sprays. Experiments were conducted in the Chatauqua district during the last two or three seasons, and successful results have been secured from the application of arsenical poisons, and Prof. Slingerland strongly advocates their use in infested vineyards, but states that the poison spray is effective only against the spring brood of caterpillars working in the blossoms, and recently set clusters. He advises two applications at the rate of four pounds of arsenate of lead in 50 pounds of water or Bordeaux Mixture. The first application should be made before the blossoms open and the second just after the blossoms fall. Now that many of our grape-growers are using Bordeaux for the control of the Black Rot and the Mildews, it is an easy matter to add the arsenical poisons to this mixture, so that the Grape-Berry Moth can be controlled at the same time as the fungus diseases.

Shade Trees.

The Spiny Elm Caterpillar, the larva of the Mourning Cloak butterfly (*Euvanessa antiopa*) was more numerous than usual this summer on elms. This caterpillar is not often sufficiently numerous to attract attention, or to destroy foliage. The different stages of this insect are interesting. The winter is passed as a butterfly, and almost any bright day it may be seen flitting about as if it enjoyed the sunshine. Its wings are of a dark, rich purplish-brown color with yellowish borders, dotted with brown. Its eggs are beautifully sculptured, and are laid in compact clusters about a twig. The caterpillars are salt-and-pepper colored with a row of red spots along

the middle of the back, and their bodies are protected by many branched spines. Their chrysalids are also spiny and they occur suspended by the tail.

The caterpillars of the *White-Tipped Moth* (*Edema albifrons*) were also very abundant this fall on the leaves of the hard maple about Guelph. They are readily recognized by their smooth, shiny body, by the numerous fine yellow and black stripes, and by the orange-red head, and the orange-red hump near the end of the body.

The Walnut Datana Caterpillars (*Datana Sp.*) (Fig. 74) were very numerous on walnut trees in the south western part of the Province in August and September, and in many cases stripped the trees of their leaves. These larvæ when full grown are about two inches in length. To the owners of shade walnuts and hickories the habits of these caterpillars are rather mysterious. When disturbed the caterpillars raise both ends of their bodies to assume a threatening attitude. They feed in colonies and at moulting period they descend the trunk of the tree and congregate in a large mass. When full grown they descend to the ground to pupate, hence their mysterious disappearance at this stage. The moths are brown, with bars crossing the front wings, which may expand one and three-quarter inches.

These caterpillars can be readily poisoned by Paris green applications, and at moulting periods captured *en masse*.

Fall Web-Worms (*Hyphantria cunea*) were more numerous this year than usual. Usually the webs are confined to forest trees, but this fall their webs were observed in many vineyards, on currant and raspberry plantations, and in apple orchards.

Their webs are unsightly objects, especially when they are large, and become filled with dead leaves, moulted skins, and excrement. The caterpillars differ in their habit of feeding from the Tent Caterpillars, as they always feed within the web. Moreover, they are very variable in color and markings,—some having a black band along the back and long white hairs, while others have two rows of prominent black marks instead of a band, and have shorter hairs.

The pupae are formed within cocoons, and are usually found at the surface of the ground, mixed with dirt, in crevices of bark of trees, under fences, &c. The moths appear in early summer, and the eggs are deposited in flat masses on the under surfaces of leaves.

There is but one brood a year in Ontario. Two or three lines of treatment may be adopted against the Fall Web-worm: (1) to spray the caterpillars with arsenical poisons, such as Paris green or arsenate of lead; (2) to destroy the webs by burning them on the tree with a torch; and (3) to clean up all refuse so as to destroy the hibernating cocoons.

The Cottony Maple Scale (*Pulvinaria innumerabilis*) was even more destructive this year than last, having been reported from many towns in the western peninsula. Briefly, the life-history is as follows:—The females winter over on the twigs, and in spring begin feeding and secreting a cottony mass for the reception of the large number of eggs which are laid at this time. The larvæ soon hatch by the thousands, and swarm over the leaves and twigs. They soon become fixed and begin forming a scale-like covering. In August they become mature, and usually in September females are fertilized by the males who die soon afterwards.

Treatment is rather difficult, but much may be done by spraying the trees with the kerosene-soap emulsion at the time the larvae are crawling. Success has followed the application of strong streams of cold water in spring, when the eggs are dislodged from the cottony mass and are destroyed. In some cases winter and spring pruning is beneficial. It is very probable,

however, that the insect enemies of this scale will soon get the upper hand and keep it in check.

The Spruce Gall Louse (*Chermes abietis*) is extending its range every year, but in the older sections the parasities are apparently keeping it in check. There are two broods annually; the eggs of the first brood appear in May in fluffy masses on the affected spruce twigs, the second in August.

Judicious pruning when practicable, and applications of kerosene-soap solution in May when the larvae are hatching will do much to prevent the spread of this insect.

The Tussock Moth (*Orgyia leucostigma*) was very injurious in our large cities, but much information has been written in this and previous reports regarding it, and it is only necessary here to note its occurrence.

REPORT OF THE BRITISH COLUMBIA BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE YEAR 1905.

The fourth annual meeting was held February 6th, 1905, at the Queen's School, Vancouver. There were present Rev. G. W. Taylor (President) in the chair, T. Wilson (Vice-President), R. V. Harvey (Secretary-Treasurer), A. H. Bush, R. S. Sherman, R. Draper and J. Towler.

The minutes of the last meeting were read and approved.

The Treasurer presented the balance sheet for the year 1904, which was passed.

The retiring officers were re-elected for the ensuing year.

It was unanimously resolved that the British Columbia Entomological Society should become an affiliated branch of the Entomological Society of Ontario, and the Secretary was empowered to conduct the necessary negotiations.

The Society now numbers nineteen active members; eight of these reside in the neighborhood of Vancouver, but the rest are so widely scattered through the Province as to make representative gatherings difficult, and severely handicap co-operation in entomological studies.

Individual members, however, have done good work, and the forthcoming list of B. C. Lepidoptera, compiled by Rev. G. W. Taylor, besides his papers on our Geometridæ, which will appear shortly, will show how much has been accomplished in the last few years.

In other orders various members are rapidly accumulating valuable notes and extensive collections: in the Coleoptera, Messrs. Taylor, Hanham, and others; in Hymenoptera, Mr. Venables; in Diptera, Messrs. Venables, Sherman and Harvey.

The season of 1905 was not notable for either abundance of insects or particularly interesting captures. It is worth noting that a moth hitherto regarded as extremely rare, *Lepisesia flavofasciata*, var, *ulalume*, Strk., was taken in some numbers both by Mr. Taylor at Wellington and by several Vancouver collectors round cherry and apple blossom in early spring. Mr. Venables of Vernon records the capture of a specimen of a fine Sphingid, *Marumba modesta*.

R. V. HARVEY,
Hon. Secretary-Treasurer.

DEC. 30th, 1905.

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Wickham, Prof. H. F.	Iowa City, Iowa.

LIFE MEMBER.

Saunders, Dr. Wm., (Director of the Experimental Farms of the Dominion)	Ottawa.

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THIRTY-SEVENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO

1906

PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

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To the Honourable WILLIAM MORTIMER CLARK, K.C.,
Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

I have the pleasure to present herewith for the consideration of your Honour the Report of the Entomological Society for 1906.

Respectfully submitted,

NELSON MONTEITH,

Minister of Agriculture.

Toronto 1907

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Province of Ontario.

Abbott, Dr. A. R.	Toronto.
Albright, W. D	London.
Baker, A. C.	"
Balkwill, J. A.	"
Barlow, B., O. A. C	Guelph.
Bethune, Prof., C.J.S., O.A.C	"
Binnie, T. H., O. A. C.	"
Black, Davidson	Toronto.
Blackmore, Miss E.	"
Bock, H. P	London.
Bond, G	Guelph.
Bowman, J. H.	London.
Brodie, Dr	Toronto.
Brown, Walter	"
Buchanan, J., O. A.C.	Guelph.
Butt, W	Oakville.
Caesar, L., O. A. C	Guelph.
Coleman, R. E.	Toronto.
Cornish, G. A.	Orillia.
Cosens, A.	Toronto.
Creelman. Pres't, O. A. C.	Guelph.
Dearness, Prof, J	London.
Dunlop, James	Woodstock.
Edmunds, Brodie	Toronto.
Elliott, W. H.	"
Evans, J. D	Trenton.
Fisher, George E	Freeman.
Fletcher, Dr. James	Ottawa.
Fraser, W. J	Toronto.
Frier, G. M., O. A. C.	Guelph.
Gibson, Arthur	Ottawa.
Grant, C. E.	Orillia.
Hahn, Paul	Toronto.
Haight, D. H	Copper Cliff.
Hallam, M	Toronto.
Hallam, R.	"
Hamilton, R. S	Galt.
Harrington, W. H.	Ottawa.
Howitt, J. E., O. A. C	Guelph.
Jarvis, Leonard	London.
Jarvis, T. D., O. A. C.	Guelph.
Johnston, James	Hamilton.
Jones, D., O. A. C.	Guelph.
Kilman, A. H.	Ridgeway.
King. R. W	Toronto.
Law, John	London.
Lawrence, C. A., O. A. C.	Guelph.
Lawson, F	London.
Maughan, J., Jr.	Toronto.
McCready, Prof. S.B., O.A.C.	Guelph.
McRitchie, A. R.	Kincardine.
Merchant, Principal F. W.	London.
Moore, T. J.	Guelph.
Morden, J. A.	Hyde Park Corners.
Mosey, Miss	Toronto.
Nash, C. W	"
Painter, A. J., O. A. C.	Guelph.
Pearson, Gerald	London.
Readwin, R.	Guelph.
Richard, A. E.	Ottawa.
Rossiter, Geo	Toronto.
Sanders, G. E., O. A. C	Guelph.
Saunders, H. S.	Toronto.
Saunders, W. E.	London.
Silcox, Sidney	St. Thomas.
Slater, A. E., O. A. C.	Guelph.
Smith, A.	Renfrew.
Smith, Walter	London.
Stewart, E.	Ottawa.
Stewart, J.	London.
Stuart, F. A.	London.
Tanton, John	Uxbridge.
Thompson, P. J.	London.
Thompson, W. Robin, O.A.C.	Guelph.
Treherne, R., C.,O.A C.	"
Walker, Dr. E. M.	Toronto.
Watson, Dr. A. H. R.	Port Hope.
Webb, J. H.	Toronto.
Westland, Malcolm	London.
Wheaton, R. R., O.A.C.	Guelph.
White. James	Snelgrove.
Williams, J. B.	Toronto.
Wood, A. A.	London.
Wood, S. T.	Toronto.
Yerex, O. E	Little Britain.
Young, C. H	Ottawa.
Zavitz, E. J., O.A.C.	Guelph.

Province of Quebec.

Barwick, E. C	Montreal.
Begin, Rev. Abbe, P. A.	Sherbrooke.
Bickell, Miss	Quebec.
Boulton, A. R. M.	"
Bowen, Miss	"
Brainerd, Dwight	Montreal.
Brainerd, E.	"
Burgess, Dr. T. J. W	Verdun.
Chagnon, Gustave	Montreal.
Denny, E.	"
Dunlop, G. C.	"
Elliott, W. R.	Sherbrooke.
Freeman, Miss I. H.	Quebec.
Fyles, H.	Levis.
Fyles, Miss W.	"
Fyles, Mrs.	"
Fyles, Rev. Dr. T. W.	"
Geggie, James.	Beauport.
Geggie, Miss Lois.	"
Gibb, Lachlan	Montreal.
Griffin, A.	"
Hamel, Miss Julia	Levis.
Hedge, Miss Lousia	"
Huard, Rev. Victor	Quebec.
Johnston, Miss M. G	Levis.
Lindsay, Col. Crawford	Quebec.
Lochhead, Prof	Ste. Anne de Bellevue.
Lyman, H. H	Montreal.
MacLeod, Miss E.	Quebec
Moore, G. A.	Montreal.
Newman, C. P	Lachine Locks.
Norris, A. E.	Montreal.
Poston, Mrs. T. A.	Levis.
Reford, L.	Montreal.
Reich, Emil	"
Robertson, Miss	Quebec.
Seton, Mrs. W. W	Levis.
Simmons, Mrs. J. H.	"
Southee, G. R.	Outremont.
Stevenson, C.	Montreal.
Tourchot, A. L.	St. Hyacinthe.
Turnbull, Lt.-Col. F.	Quebec.
Turner, Hon. Richard	"
Turner, Mrs. R.	"
Wade, Miss	New Liverpool.
Weir, Douglas	Montreal.
Winfield, Mrs	Quebec.
Winn, A. F.	Montreal.
Wood, Rev. Edmund	"

Alberta.

Baird, Thos.................High River.
Dod, F. H. Wolley..........Millarville.

British Columbia.

Anderson, E. M.............Victoria.
Anderson, J. R............. "
Bryant, T..................Vancouver.
Bush, A. H................. "
Cockle, J. W...............Kaslo.
Danby, W. H...............Rossland.
Dashwood-Jones W. A.......New Westminster.
Day, G. O..................Duncan's St'n.
Draper, R..................Vancouver.
English, T. M..............Cowichan St'n
Findlay, Rev. G. H.........Fort Steele.
Foster, F..................Vancouver.
Hanham, A. W..............Duncan's St'n.
Harvey, R. V...............Vancouver.
Keen, Rev. J. H............Metlakatla.
Livingston, C..............Duncan's St'n.
Marrion, A. H..............Vancouver.
Reed, E. Baynes............Victoria.
Sherman, R. S..............Vancouver.
Skinner, E. M..............Duncan's St'n.
Taylor, Rev. G. W..........Wellington.
Towler, J..................Vancouver.
Venables, E. P.............Vernon.
Wilmot, E. S............... "
Wilson, T..................Vancouver.

Manitoba.

Criddle, Norman............Aweme.
Dennis, A. J...............Miniota.
Heath, E. F................Cartwright.
Marmont, L. E.............Rounthwaite.

Nova Scotia.

Mackay, Dr. A. H...........Halifax.
Russell, John...............Digby.

Saskatchewan.

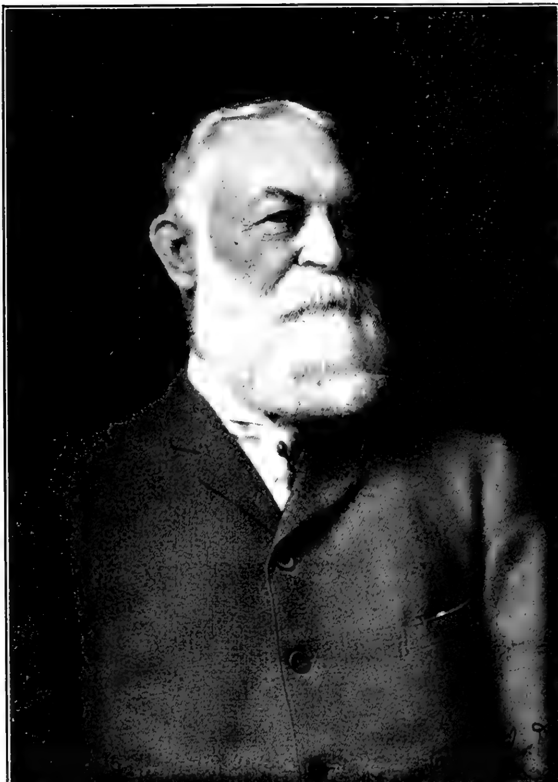
Croker, A. J................Redvers.
Willing, T. N...............Regina.

Honorary Members.

Ashmead, Dr. W. H.........Washington, D. C.
Cockerell, Prof. T. D. A....Boulder, Colo.
Cresson, Ezra T............Philadelphia, Pa.
Edwards, William H.........Coalburgh, W. Va.
Howard, Dr. L. O...........Washington, D. C.
Scudder, Dr. S. H...........Cambridge, Mass.
Smith, Prof. J. B............New Brunswick, N. J.
Uhler, P. R.................Baltimore, Md.
Webster, F. M..............Washington, D. C.
Wickham, Prof. H. F........Iowa City, Iowa.

Life Member.

Saunders, Dr. William.......Ottawa.
(Director of the Experimental Farms of the Dominion.



JOHN D. EVANS, C.E.
President of the Entomological Society of Ontario, 1904-1906.

PLATE A.

1. Vein Gall of White Ash. *Eriophyes sp.*
2. Chokecherry Mite Gall. *Eriophyes sp.*
3. Hawthorn Serpentine Gall. *Eriophyes sp.*
4. Manitoba Maple Wart Gall. *Eriophyes sp.*
5. Poison Ivy Mite Gall. *Eriophyes sp.*
6. Birch Bud-Gall. *Eriophyes sp.*

(See page 56.)

PLATE B.

1. Sugar Maple Pink frost-gall. *Eriophyes sp.*
2. Manitoba Maple frost-gall. *Eriophyes sp.*
3. Rock Elm frost-gall. *Eriophyes sp.*
4. Beech frost-gall. *Eriophyes sp.*
5. Elm mite gall. *Eriophyes ulmi.*
6. Elm mite gall. Enlarged opening on under surface.

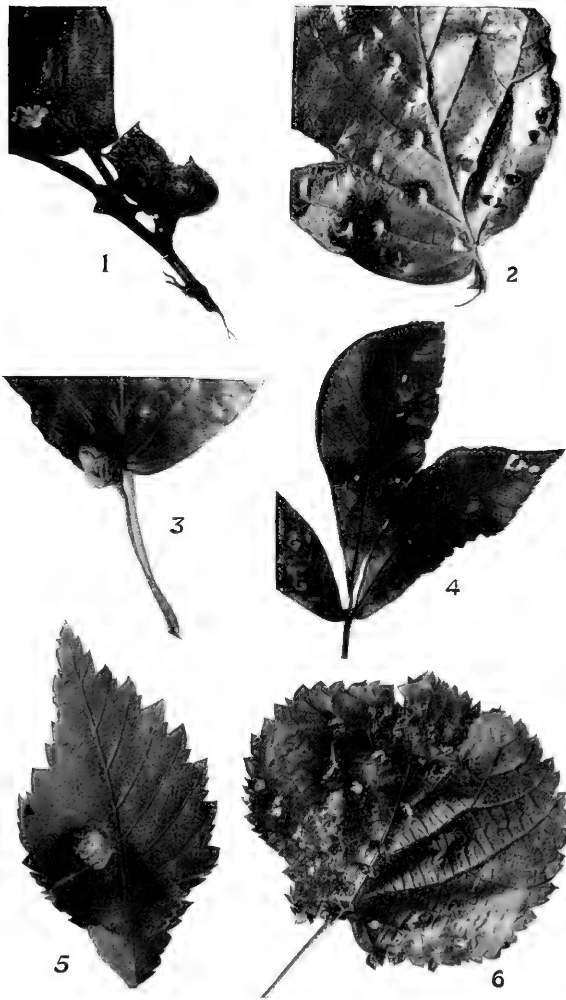


PLATE C.

1. Spiny Witch-Hazel Gall. (*Hormaphis spinosus.*)
2. Witch-Hazel Cone Gall. (*Hormaphis hamamelidis.*)
3. Cottonwood Petiole Gall. (*Pemphigus populicaulis.*)
4. Hickory Cone Gall. (*Phylloxera caryae-fallax.*)
5. Cockscomb Gall on Elm. (*Colopha ulmicola.*)
6. Basswood Mite Gall. (*Eriophyes abnormis.*)

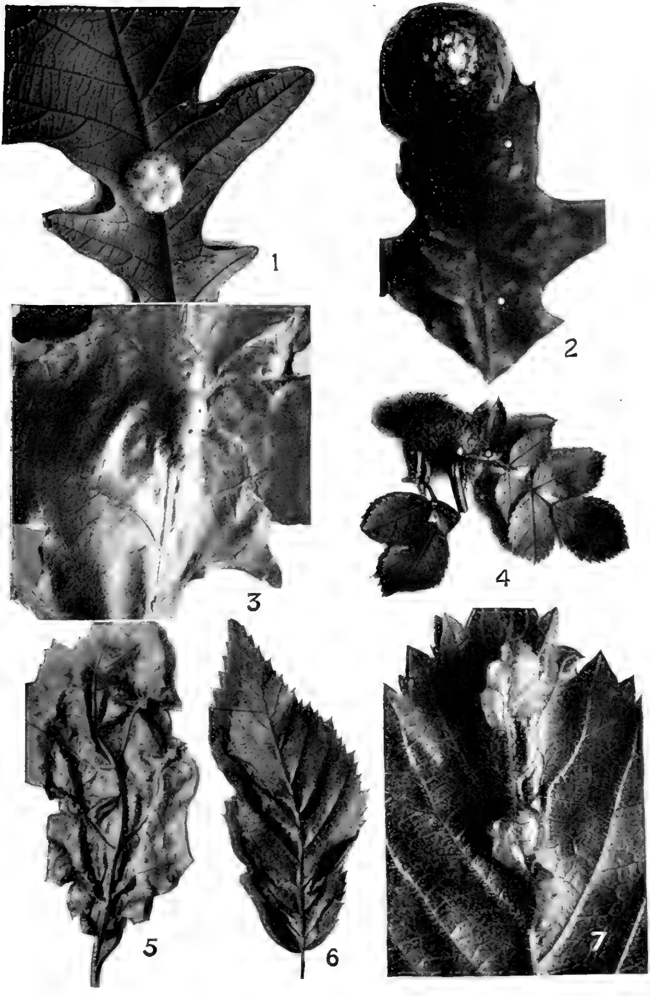


PLATE D.

1. Furry Ball Gall on Oak. (*Andricus lana.*)
2. The Larger Oak-Apple. (*Amphibolips confluentis.*)
3. Oak Midrib Gall. (*Andricus piger.*)
4. Mossy Rose Gall. (*Rhodites rosae.*)
5. Vein Gall on Oak. (*Cecidomyia quercus-majalis.*)
6. Vein Gall on Blue Beech. (*Cecidomyia pudibunda.*)
7. Virginian Creeper Midrib Gall. (*Cecidomyia sp.*)

PLATE E.

1. Ball Gall on Hickory. (*Diplosis caryae.*)
2. Spiny Ball Gall on Wild Rose. (*Rhodites bicolor.*)
3. Ball Gall on Wood Nettle. (*Cecidomyia urnicola.*
4. Rose Stem Gall. (*Rhodites globulus.*)
5. Ash Gall. (*Cecidomyia pellex.*)
6. Eye Spot Gall of Maple. (*Cecidomyia ocellata.*)

PLATE F.

1. Soft Maple Mite Gall. (*Eriophyes quadripes*).
2. Two specimens on left, Elliptical Goldenrod Gall. (*Gelechia gallaesolidaginis.*)
3. Two specimens on right. (*Trypeta solidaginis.*)

Entomological Society of Ontario

1906.

To the Honourable Nelson Monteith, Minister of Agriculture:

SIR,—I have the honour to present herewith the Thirty-seventh Annual Report of the Entomological Society of Ontario for the year 1906. It contains the proceedings of the Forty-third Annual Meeting of the Society, which was held at its new headquarters in the Ontario Agricultural College, Guelph, and also papers on practical and descriptive entomology which have been prepared for the information of farmers, fruitgrowers and gardeners as well as others who are interested in the work of noxious and beneficial insects.

The Canadian Entomologist, the monthly magazine published by the Society, has been regularly issued during the year, and has now completed its thirty-eighth annual volume. It continues to maintain its well-established reputation for scientific entomology.

I have the honour to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Ontario Agricultural College, Guelph. Editor.

Entomological Society of Ontario.

OFFICERS FOR 1906-1907.

President—James Fletcher, LL.D., F.R.C.S., F.L.S., Entomologist and Botanist of the Experimental Farms, Ottawa.

Vice-President—Tennyson D. Jarvis, B.S.A., Lecturer in Entomology and Zoology, Ontario Agricultural College, Guelph.

Secretary—E. J. Zavitz, B.S.A., Lecturer in Forestry, O. A. College, Guelph.

Treasurer—S. B. McCready, B.A., Professor of Botany and Nature Study, O. A. College, and Macdonald Institute, Guelph.

Librarian—Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Professor of Entomology and Zoology O. A. College, Guelph.

Curator—J. Eaton Howitt, B.S.A., Lecturer in Botany, O. A. College, Guelph.

Directors—Division No. 1—C. H. Young, Hurdman's Bridge.
Division No. 2—C. E. Grant, Orillia.
Division No. 3—J. B. Williams, Toronto.
Division No. 4—C. W. Nash, Toronto.
Division No. 5—George E. Fisher, Burlington.
Division No. 6—J. A. Balkwill, London.

Directors—(Ex-Presidents of the Society)—Professor Wm. Saunders, C.M.G., LL.D., F.R.S.C., F.L.S., Director of the Experimental Farms of the Dominion, Ottawa; Rev. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Guelph; W. Hague Harrington, F.R.S.C., Ottawa; Professor John Dearness, Vice-Principal Normal School, London; Henry H. Lyman, M.A., F.E.S., F.R.G.S., Montreal; Rev. T. W. Fyles, D.C.L., F.L.S., Levis, P.Q.; Professor Wm. Lochhead, B.A., M.S., Macdonald College, Ste. Anne de Bellevue, P.Q.; John D. Evans, C.E., General Manager Central Ontario Railway, Trenton.

Auditors—B. Barlow, B.S., and H. S. Peart, B.S.A., Ontario Agricultural College, Guelph.

Editor of the "Canadian Entomologist"—Rev. Prof. Bethune, Guelph.

Editing Committee—Dr. Fletcher, Ottawa; H. H. Lyman, Montreal; J. D. Evans, Trenton; Prof. Lochhead, Ste. Anne de Bellevue, P.Q.; G. E. Fisher, Burlington; J. B. Williams and C. W. Nash, Toronto.

Delegate to the Royal Society—A. F. Winn, Montreal.

Entomological Society of Ontario.

ANNUAL MEETING.

The forty-third annual meeting of the Entomological Society of Ontario was held in its new headquarters at the Ontario Agricultural College, Guelph, on Wednesday and Thursday, October 10th and 11th, 1906; the sessions were presided over by Vice-president Dr. James Fletcher, Dominion Entomologist and Botanist, Ottawa. Among the members present were Mr. John D. Evans, Trenton, the retiring President; Mr. Henry H. Lyman, Montreal; Mr. Arthur Gibson, Central Experimental Farm, Ottawa; Mr. C. H. Young, Hurdman's Bridge; Dr. Brodie and Messrs. C. W. Nash, J B. Williams and Paul Hahn, Toronto; Mr. G. E. Fisher, Burlington; Mr. J. Fred Smith, San Jose Scale Inspector for Ontario; President Creelman, Professors Hutt, McCready and Bethune, Messrs. Jarvis, Zavitz, Eastham, Howitt, Barlow and Peart, of the Ontario Agricultural College and the Macdonald Institute. Letters expressing their regret at their inability to attend were received from the Rev. Dr. Fyles, Levis, P. Q.; Professor Lochhead, Macdonald College, Ste. Anne de Bellevue, P. Q.; Mr. A. McNeill, Chief of the Fruit Division, Department of Agriculture, Ottawa; Messrs. J. A. Balkwill, W. E. Saunders and John Law, London; Mr. W. D. Kearfott, Montclair, N. J.

Owing to the lateness of the train from the east, there was only time for a brief meeting of the Council on the morning of the 10th, at which some necessary business was transacted.

In the afternoon of Wednesday, October 10th, the Society met at 2.30 o'clock; owing to the large attendance, over a hundred being present, the meeting was held in the spacious Massey Hall. The proceedings began with a discussion on the Codling-worm.

THE CODLING-WORM DISCUSSION.

Dr. Fletcher, the chairman, opened the debate by giving an outline of the life-history of the insect, the extent of its ravages and the ordinary methods of dealing with it. The following is a condensed summary of his remarks:

The Codling Moth is probably one of the most injurious insects that we have to deal with in Canada in fruit work. The remedies are all well-known, and are all sufficient, if a proper amount of care is taken by fruit growers. However, it is neglected by many, and I think the present state of the apple crop of this year is very largely due to fruit growers and farmers generally not having paid attention to the regular remedies which they ought to have made use of and not keeping their orchards clean and free from the codling moth as well as they might have done. A great deal of work and care are requisite, and as its habits vary somewhat in different parts of

Canada, it is necessary to know its life history. In my own observations I have found that east of Toronto, or about Toronto, there is practically only one brood in the year, while west of Toronto there are two. This means that in Western Ontario the fruit grower has a different and harder task before him. In Eastern Ontario, having only one brood to deal with, it can be practically controlled by the spring spraying, which everybody seems to have energy enough to carry out. West of Toronto, it seems necessary to supplement the work of spraying by banding the trees with burlap, or other material, giving the caterpillars a shelter in which to spin their cocoons, and then destroying them before the moths emerge. Where spraying and bandaging the trees are faithfully carried out, the Codling-moth is very materially reduced in numbers. But notwithstanding all that is done, the apples going to market every year are to a large extent damaged by this insect, and the unsightly appearance of the apple with injury on the side or at the calyx end reduces its selling value. We thought, therefore, that it would be advisable to have a discussion this afternoon upon this important insect pest, as in every conference of this kind some fresh points of value are sure to be brought out. It is no exaggeration to say that at least one-quarter of the loss sustained by fruit-growers every year is caused by the Codling-worm, and therefore it is a matter of great financial importance that we should learn the best and most effective methods of dealing with this pest.

Dr. Fletcher then described the proper methods of spraying fruit trees and applying bandages, and stated that, if fruit-growers would faithfully adopt this cheap means of dealing with the insect, they would save a very large amount of their income derived from orchards.

He next referred to the parasites which, in many instances, effectually keep down the insect enemies of crops. It often happens that a particular insect is extremely abundant one year while the next year few are to be found. This reduction in numbers is largely due to the work of parasites. Dr. Brodie, of Toronto, has for many years made a special study of the Codling-moth and of the parasites which affect it and a number of other injurious insects. He will tell us this afternoon what he has done in this direction and the results of his investigations. The introduction of a new parasite from some other part of the world is a very difficult matter and requires long continued efforts in order to secure satisfactory results. The introduction of the *Vedalia cardinalis* into California to destroy the Cottony-cushion scale is probably the only marked instance of successful work of this kind which has ever been brought about. It is hoped that the efforts now being made to establish a parasite of the Codling-worm in California will be successful; there are great difficulties to be overcome, and it will be some time before the parasite will become sufficiently numerous to control this enemy of the fruit. The study of parasites covers a field of very excellent and useful work, but up to the present time there have not been many practical results.

Dr. Brodie, before reading his paper, stated that he was a firm believer in the good results to be obtained through parasites. Dr. Bethune was the first person in North America to advocate the introduction of parasites to keep in check the imported insects that ravaged our wheat fields. His own recollections went back to sixty years ago when the Codling-worm was utterly unknown in Ontario; apple trees were then very large and productive. It was not till somewhere about 1858-1860 that it made its appearance. During the last ten years he had been pursuing rather carefully the study of this insect, taking in the larvae, breeding them through the winter and discovering to what extent they were attacked by parasites. He found it a very

difficult matter to procure a sufficient quantity of material for study, that is, of the larvae and pupae, during the different seasons of the year, and had never been able to get a satisfactory supply. Dr. Fletcher has told us that if the remedies prescribed, which are well known, were fully carried out, the insect would be kept well under control; he entirely agreed that these methods are the most rational and successful for combatting the ravages of the insect. Prevention by parasites has long been discussed and surprise has been expressed that their influence for good has been practically nothing. This failure, he believed, was largely due to the counter influence of secondary parasites which have an extended geographical range. He then read the following paper:

PARASITISM OF CARPOCAPSA POMONELLA.

By Dr. W. Brodie, Toronto.

The all important problems of parasitism, as means for checking the increase of plant eating insects, have for more than half a century been much in entomological literature, and it seems that parasitism is recognized everywhere as the great power arranged by nature to check the rapid increase of plant eating species.

The parasitism of the Codling-moth has not been overlooked. Several species of primary parasites have been detected and identified, and surprise is often expressed that their influence for good is so little, we may say inappreciable. Now there may be several reasons for this; it may be the primary parasites we know are not the species arranged by nature to check the over increase of the Codling-moth. But one special reason I have detected is the presence of a secondary parasite, namely, *Dibrachys boucheanus*. This insect has a wide geographical range in Asia, Europe and North America, and although one of the smallest insects, exercises an immense influence in the world of insect life as a checking and balancing-up power. So far as known to us, it is without doubt an injurious insect, as most secondary parasites are.

On Aug. 28, 1905, I received from Mr. W. A. Peer, Freeman P. O., a small box containing 18 *C. pomonella* larvae and pupae. On Aug. 29, there emerged 2 moths, 1 primary parasite, *Pimpla pteralis*, and 12 secondary parasites, *Dibrachys boucheanus*. Sept. 20, 1905, a package from Stayner gave from June 2-10, 1906, 17 moths and one primary parasite, a Pimpla. Sept. 25, 1905, a package from Prescott, gave in June, 1906, 4 moths and 2 primary parasites, 1 Pimpla, 1 Ephialtes. I may say that I am indebted for identifications to Dr. Ashmead, of Washington, acknowledged to be the highest authority on parasitic Hymenoptera in the world.

During the many years in which I have been engaged in working out some of the problems of parasitism, I have found the primary parasitism of the Codling-moth to be about 0.5 per cent. No doubt it would be much greater were it not for the presence of the secondary parasites. In a further pursuance of the many interesting, practical and important problems presented, such as the life histories and relations of the primary and secondary parasites known to infest the larvae and pupae of the Codling-moth, and the relationships of these to allied species, preying abundantly on numerous species of Tortricidae, more or less common in open woods and thickets

everywhere throughout the Province, a careful comparison of the hosts and habits of our native species with closely related foreign ones would be of very great value. This might result in the importation of species more potent for good than our native ones.

In order to arrive at a satisfactory solution of the many problems involved in the investigation of this subject, an ample supply of material, larvae and pupae of the Codling-moth, must be at hand at all seasons, collected in many localities throughout the Province.

Surely the magnitude of the interests involved, and the rational claims of the indicated scientific method are such as to justify a sufficient effort by entomologists and fruit growers in determining the efficacy of parasitism in effectually overcoming the Codling-moth pest.

Dr. Brodie went on to say that the parasites he referred to are well-known, having a wide range over the United States and Canada. He had obtained them from the north, east and west of Ontario. The secondary parasite is exceedingly small, less than one-sixteenth of an inch, and on looking back he thought that his precautions were not sufficient, and that these minute creatures may have escaped detection. In pursuing an investigation of this kind, it is necessary for the worker to carefully fix his jars or bottles in such a way that these very small insects may not escape, but be retained for observation. The jars used should be small, but yet large enough for the atmosphere not to be too moist; they may be covered with cheese-cloth or some other thin material. This is a very important subject and should form an attractive field for work, affecting as it does our largest fruit industry.

Prof. Hutt said that he had travelled over a considerable portion of the Province this summer and found the Codling-worm exceptionally bad, especially in the Niagara district and the eastern part of Ontario. In some orchards half the crop was destroyed. It was now making its appearance in Algoma, and had this summer made some headway on St. Joseph's Island. It needs careful watching in order to keep it in check, as it is covering all sections where apples are grown. If parasites are of use in reducing the numbers of the pest, they are not increasing fast enough to control it to any extent. Something more than parasites is required, and that is the employment of the established remedies by the fruit-growers themselves.

Mr. C. W. Nash said that the question of dealing with the Codling-worm was one of the greatest possible importance. As matters now stand, we are simply covering the ground with trees that to a great extent give us little in return. The remedies spoken of by Dr. Fletcher are certainly very easy of application and always show good practical results, provided that these remedies are applied thoroughly and at the proper time. The great difficulty that we find in dealing with the farmer is that he either does not believe in the practicability of these remedies, or he does not apply them just when he should. In the first place, with regard to spraying, as referred to by Dr. Fletcher, some men will spray their trees just when they happen to have the time to do so, without regard to the state of the fruit, or the tree, or the stage of the insect. In many cases where spraying is done at the wrong time, it is just money thrown away. If spraying is to be efficacious at all, it must be done before the larva has entered the apple. To catch them just at that particular time requires observation and the exercise of some little judgment. The codling moth deposits its eggs near or upon the little apple as it is first formed, about the time the petals drop from the blossoms. Those who have observed apples will have noticed that the little embryo apple stands erect upon the stem with the calyx expanded. A few days after

the petals have fallen, the stem curls over, the apple hangs down, and the calyx closes. If you spray after this has taken place, you are simply throwing away material, as there is no chance of its getting into that little calyx cup. To do your spraying, then, so that it should be efficacious, you should spray as soon as the petals fall, while the apple is erect. You then have a chance, a good chance, but even then nothing more than a good chance, of getting a small portion into the calyx cup. If you do, when the larva goes into the calyx cup and makes its first meal with the intention of entering the apple, it is very likely to be its last. Very little poison will be necessary at that time. The insect is remarkably weak and small. You cannot, however, hope to get a little poison into every apple on the tree, some will be missed and escape. But that is the point you must bear in mind, to spray at the proper time. Having done that and reduced very largely the number of larvae that are in your apples, you should supplement that treatment by afterwards bandaging the trees. If you do that, the probability is that it will not be a very great tax upon the product. A farmer in my neighborhood has a large orchard of old trees. He sprayed at the proper time, and he thought by so doing he had done everything that was necessary, and others had told him the same. I told him to bandage his trees as well, that it is much better to be safe than sorry, but he ridiculed the idea. So I took an old bag and did it myself, and eight days afterwards I went back. We took that bag off and there were seventy-two cocoons beneath the bag. These are the two remedies that are certain.

Another point to consider, and this is one that I think you should take into your deepest consideration, and that the government should enforce. It is that every man who has apple trees should be compelled to take precautions against the Codling-worm. A man who has large interests at stake will undoubtedly make some effort to protect his property, but the man on the small village lot with a few straggling trees—what does he care? The result is that these few scattered trees here and there enable cocoons to mature in a sufficiently large proportion to provide codling-moths for the whole Province. It has come to this, that unless a man will take care of his trees he should not be allowed to have them. I have tried myself for very many years to find out if there is any parasite affecting the codling-moth likely to be of any service. I have consistently failed to do anything of the kind. It was very rarely that I ever found a parasite. It may be that in some sections and in some seasons they are abundant. The parasites will have to be more abundant to show their effects, but so far as the codling-moths are concerned, I think you will have to look to your own efforts to reduce them. The very nature of the moth makes it almost exempt from any attack by insect parasites. It is practically exempt from any injury by outside enemies. In the pupa stage it is destroyed by birds. If we had more trunk-cleaning birds the orchards would have fewer codling-moths. You should take into consideration some means of compelling persons who maintain apple trees to look after them, or else see that they are prevented from keeping them.

Dr. Fletcher said that the experience in this country of trying to control people by legislation proved that such efforts were almost entirely useless. Now, the question of whether it is worth while to spray or not is one, I think, I need not discuss. All evidence and statistics show that it does pay to spray, and instead of losing 75 per cent. of the crop you can save it, as an average. At most the cost of spraying trees the number of times that it is necessary is less than 25 cents for large trees, and the number of bushels you will get off them will more than pay that expenditure many

times over. The present year, with a short crop in many sections, shows that the benefits to those that have sprayed will be enormous, and these are just the years when the work is most effective. The crop is small, it requires less expenditure for handling and shipping, and more than that, the sample is finer. When orchards are properly sprayed one inspection is sufficient to, at any rate, gain the sympathy of any fruit grower with spraying. He will spray every year after that. As to the advantage of spraying an orchard regularly, the benefits are very marked. At Ottawa, the horticulturist at the Experimental Farm now knows that he cannot afford not to spray. He has learned now to spray effectively, and the advantages are shown by the fact that for the past eight or ten years the codling-moth is almost unknown in these orchards, and I can get no specimens there. How far do you think I have to go to get specimens of the codling-moth? Just beyond a sixty-foot row of trees. I canot find any codling-moths in our own orchards on the Farm, but need only go to these trees outside to get all I want. That shows the local benefit to the man who sprays, and it shows that although the codling-moth flies, it does not fly to such long distances as to impair the benefit to the man who sprays; while he who does not spray must pay the price that his loss entails.

In addition to the benefits from the remedies already referred to, it is most advisable to exercise the greatest care in examining and cleaning out any barrels or cases used for packing fruit which are brought in from outside sources and which may have contained infected fruit, as these may contain cocoons of the codling-moth. He had now at Ottawa cocoons of this insect with larvae still unchanged which were spun in July, 1905. A very few moths emerged in August, 1905, many in June, 1906, and some would not emerge till the spring of 1907. This, he thought, was a new fact in the life-history of the insect.

Mr. G. E. Fisher: In regard to treating any troublesome insect, I always find it worth while to look for a remedy. With the farmers there seems to be a difficulty about spraying. As a rule, fruit-growers do not like to spray, and a great many do not spray, and the reason is because they have never done it. Now, I am a little surprised that in all this discussion regarding the codling-worm no reference has been made to the hog remedy. In a large orchard that I am familiar with, there are 2,000 apple trees in bearing, and there are any amount of moths. As a rule, an apple tree can well spare some of its fruit. The trees are better without it. Those apples that are attacked will fall to the ground, then we want about fifty hogs in an orchard of ten or twenty acres to follow up these apples and pick and eat them, and so destroy the worms. Dr. Fletcher has already explained the second brood that does the damage in this country. The first is a benefit by reducing the superabundance of fruit. If we can follow up those apples that fall, we have a remedy that is very easy to apply, will work out very satisfactorily indeed. A great many people seem to think that apples are of no advantage to hogs. I knew a man a few years ago, and he had a lot of apples and hogs. I told him to turn his hogs into his orchard, and he stated that he thought they would get too thin if he let them run, but finally he put them in, and the first thing he knew his hogs were too heavy to sell. They were beyond the limit. He has said ever since that there is an advantage in apples in connection with hog-feeding. I have found the hog remedy a very useful one, and perhaps you would scarcely think it, a hog has a very acute hearing, and if the ground is at all hard (we cultivate in the early part of the season), I have seen a hog's ears stand up when an apple fell and he would listen a moment and then go and find that apple, perhaps a hundred

yards away. Another thing in connection with hogs, they are pretty good scavengers. I have noticed hogs follow a caterpillar along the ground, and wait until he had caught up and then eat it. They clean up the insects very nicely.

Dr. Fletcher: You mean pigs, not old hogs, do you not?

Mr. Fisher: I mean growing pigs.

Dr. Fletcher: Did you find that the pigs rooted too much?

Mr. Fisher: No difficulty in that way. On different occasions the orchard was sown with peas and before the peas were ripe the apples were falling. The pigs not only ate the peas and apples, but plowed the ground as well.

Mr. T. D. Jarvis exhibited some apples that were affected by the codling-worm, and spoke first of the good work performed by woodpeckers in puncturing the bark and extracting the larvae from their winter quarters. He then gave an outline of the life-history of the insect at Guelph, stating that about fifteen per cent. of the first brood of worms pupate in the summer, and the moths that come from them produce a second brood. The remainder pass over to the next year. There is thus at Guelph a very limited second brood.

Dr. Fletcher said that this percentage is very interesting as showing that there is a small supplementary brood of fifteen per cent. at Guelph. The locality is thus included in the western part of the Province where double-brooding to some extent exists. At Ottawa the proportion of early maturing moths is between two and five per cent., varying in different years. These moths lay eggs and a few larvae come from them. In the country west of Toronto—at Erindale on the Credit for instance—there are two regular broods, and very few of the first brood pass through the winter as caterpillars. These variations in different parts of the country are points which the Entomologist has to be on the watch for. He was much interested in Mr. Jarvis's account of the value that he placed upon the work of woodpeckers.

Mr. Peart said: I have not been in the east, but in the western part of the Province, along the Detroit River, and going through the Niagara District, and also at Oakville, the Codling-worm was worse this year than I have ever before seen it. No particular pains had been taken with spraying as a rule, but in those sections where spraying was done at all carefully and at the right time, there have been marked results. It was owing to the scarcity of labor that spraying was not done. It is a very good object lesson to notice the effect in the district where spraying was practised, and compare it with those where it was neglected.

Mr. Zavitz said that apple-growers in County of Durham had made enquiries regarding an insect that attacked the calyx end of the apple, but did not penetrate into the fruit. He wished to know whether there was any other insect that did this, or was it the codling-worm?

Dr. Fletcher replied that there are two other insects that attack the apple—the Plum-moth *Semasia prunivora*, Walsh, called also the Lesser Apple-worm in British Columbia, and a small caterpillar in the Province of Quebec. The latter bores under the skin and works near the surface, destroying the value of the apple for packing and shipment.

Mr. Jarvis suggested that the insect referred to by Mr. Zavitz might be the second brood of the Codling-moth, but Mr. Zavitz thought not, as it simply worked around the head of the apple.

Mr. Fisher: In regard to the right time to spray for Codling-moths, Mr. Nash said that the bee people were very anxious that the prohibition

should include the entire period of bloom. But the Government would not allow that, and the Act read "during the period of full bloom." It has been my experience that you cannot get after the codling-moth any too early, and it is desirable to spray before the blooming is entirely completed. We think this is correct.

Dr. Fletcher: I do not personally: have you seen the moth or eggs before the blossoms have fallen?

Mr. Fisher: Yes, I think so.

Dr. Fletcher: At Ottawa the moth does not appear for 8 or 10 days after the blossoms have disappeared. In Nova Scotia I have found fresh eggs on apples as large as marbles.

Mr. Fisher: We find better results from spraying before the bloom is entirely completed.

Dr. Fletcher: But you have not found the moth or eggs?

Mr. Fisher: I think so.

Dr. Fletcher: That is an important point.

Mr. Fisher: I have not been doing any packing of fruit, but those who do pack fruit say that our pears have no codling-moth this year, while apples are badly affected. Pears have escaped the attack. Is this the general experience?

Mr. Jarvis: At Guelph we made examinations and found plenty of the codling moths in the pear, but did not notice whether it was less abundant than usual.

Mr. Fisher: Our pears are usually pretty wormy, and it is very disappointing to have to throw out a nice large pear for the sake of a small hole. In previous years we have lost quite a large quantity.

Mr. Jarvis asked what varieties of pears are most abundant this year? Is the Flemish Beauty free from worms?

Mr. Fisher replied that there is a good pear crop this year, and that he believed the Flemish Beauty to be free. It might be of interest to mention that some Clapp's Favorite pears were shipped from Burlington to Glasgow this year successfully; they went through safely and sold at a high price.

Dr. Brodie: I should like to say that very few people have ever seen the eggs of the codling-moth. I have been fortunate enough to see them. The process is this, the egg was laid at the lower part of the apple; it is very small, of course. In about an hour after hatching the larva had moved to the upper part of the apple and commenced making holes. I think it has been mentioned that the larvae eat the skin of the apple. This is a mistake; larvae bite a hole in the skin, but do not eat the portions bitten out; they are laid aside and very little is swallowed. In about a day they are buried in the fruit and they immediately turn around (my own experience) and close up the opening with silk. Six species of parasites have been described in North America. These parasites thrust their ovipositors into the larvae through the opening made by the worm. We all know that there is about two or three days' difference in the emergence of the larvae from the egg. A large number, say 10 or 20 per cent. perhaps, will come out in the beginning and another proportion at the end of the week. If you wished to follow it up, you would have to be spraying continually. The larvae do not emerge all on the same day, perhaps not in the same week. Larvae that have come out of the same brood will be apt to emerge at different times.

Dr. Fletcher: The time of egg-laying and hatching is a very important point. The old accounts state very positively that the egg was laid in the calyx of the apple, and that in spraying you had to get your Paris Green into that cup. Later observations by Professor Washburn, in Oregon,

show that the eggs are laid on any part of the apple, and Mr. Simpson found as many on the leaves as on the fruit. The main benefit from spraying is not so much that you get the spray into that cup, because the caterpillars begin life both on the leaves and fruit. They crawl about a little and then penetrate the fruit. I have seen them when they first get into the cup of the apple; they have there a place to get a purchase to make the first hole, and they are able by pressure upon the opposite side to penetrate the skin. The egg is exceedingly minute and like a little fish's scale, perfectly flat and silvery. It does not stand up as a prominence on the side. To see it you must take the apple, hold it sidewise, and look against the light and it will shine as a fish's scale. The young caterpillar hatches from that and crawls about on the apple. It is, of course, a very small insect and requires attention and time to see it. Most crawl towards the calyx end. With the second brood, the injury is often where two apples come together. At Ottawa we have come to the conclusion that with us the proper time to spray, if only one application is made, is not only not during the time of bloom, but not until even a week after the blossoms fall. The eggs are laid upon the young fruit. Nearly all apples when they are in the flowering stage are covered with a thick down, and the egg of the moth cannot be affixed to the side at that time. This is simply a matter of observation. The laying of the eggs certainly continues for over a week after the apple has formed. We never found an occasion where it was necessary to spray trees for the codling-moth during the time they were in bloom.

Mr. Crow inquired whether there is any satisfactory way of killing the second brood.

Dr. Fletcher replied that bandaging the trees is the most effective method. By that means many caterpillars can be caught and destroyed. Spraying has some effect, but not so much as in the case of the first brood, because the foliage is so much thicker, rendering the work more difficult.

Mr. Jarvis said that he had conducted experiments with bandages, and on one occasion found about 300 worms under a single bandage in two weeks' time. He began about the middle of July. The number of worms under a bandage varied very much.

Dr. Fletcher considered this too late for beginning and recommended the early part of the month for commencing to bandage. It was no doubt the most effective method of preventing injury from the second brood.

Mr. Caesar said that he had been this summer with Mr. Tweddle, who has an orchard of about 70 acres; and he was going to ask the same question as Mr. Crow. What time is it necessary to begin spraying to get the best results in preventing the second brood of the insects? They sprayed this orchard about three times in the early part of the season, and then did not spray again until about the 20th of August. He noticed in looking over the apples (Northern Spy) that they would probably have about thirty-three per cent., or more, of them affected by the moth. He wondered whether if they had been two weeks earlier this loss might have been prevented. As for bandaging, with an orchard so large it was almost impossible for them to do it. He thought they would do better to give the time to spraying. He wished to know what is the estimated cost of bandaging.

Dr. Fletcher: The question is a matter of expenditure and returns. If it pays, it does not matter if you pay $1,000 to bandage if you make $2,000 out of it. For the returns that you get from it, bandaging certainly pays, and it must not be forgotten that the very word spraying was unknown twenty years ago. Mr. Fisher will remember the first old Robertson pump, made at Grimsby. Now thousands of pumps are sold every year,

and more people buy them every year. Mr. Tweddle would have made it pay if he had bandaged his trees. The most important question was whether he could get the actual labor necessary. It certainly will pay if you destroy the caterpillars, for they destroy the fruit.

Mr. Jarvis: Was the orchard sprayed the previous year?

Mr. Caesar: It was sprayed during the past three or four years. There are twenty-five acres in the orchard. It was little pruned and had been overrun with the canker worm. $3,000 was made out of the orchard, so he thought it paid to spray. As to pears, he saw very few of his pears affected by the codling-moth.

Dr. Fletcher: The question of the exemption of pears this year is very interesting, and I can only suggest that it has something to do with the season. The effect of the seasons on insects is sometimes very much more apparent than on plants.

Mr. Jarvis: What was Mr. Tweddle's experience in bandaging? Why has he given it up? Did he use burlap?

Mr. Caesar: The real reason was the difficulty in getting labor. Mr. Tweddle spoke to me and said he would like to bandage a number of his trees. We prepared a quantity of bandages of simply coarse sack material, with the intention of putting them on his trees; but we could not get men enough to go around the orchards, and the owner believed that he had been so successful in spraying in previous years that he could do without the bandaging.

Mr. Jarvis: If there were 300 worms under one bandage in two weeks' time, it should pay to bandage. I found here at the College that bandaging was of very great benefit.

Dr. Fletcher: We have come to the conclusion that spraying is a good practice because we get clean orchards. But where there is a second brood, that must be supplemented by bandaging the trees. Mr. Fisher's experience that pigs and sheep, particularly pigs, destroy the infested apples and thus do a great deal of good in orchards is important. The time to spray will vary in different localities, and it will also vary with the different varieties of apples, as different varieties flower at different times. Mr. Fisher's experience is that it should be done as soon after the time of full bloom as possible. I find no advantage in that, and there is certainly a great disadvantage in spraying during bloom to those who keep bees, for direct experiments have shown that bees have been poisoned by sucking nectar from the flowers or drinking liquid from trees that were sprayed. Therefore, I for one think that the Ontario law is very well framed as it is, and that it should be made a misdemeanor to spray trees while in blossom; because bees are now an important part of the agriculture of Canada and particularly they are very useful to the fruit-growers in effecting the fertilization of blossoms. The time when to spray is after the blossoms have fallen, and then it must be done well. Cover the whole tree with spray and use a proper nozzle; the nozzle is as important as the material and the pump. To get a very fine spray it is desirable to find out the very best implement. We have in Canada an excellent pump, the Spramotor, with the movable discs, invented by Mr. Fisher, which is the best form of spray nozzle I have ever used. It enables one to use a very small quantity of liquid, for what is required in spraying is to have the liquid so fine that it falls on the trees as a mist or as a fine spray, and as soon as the spray begins to drip it is time to remove nozzle to another part in order to save material and injury to the trees. Arsenate of lead is highly recommended and its advantages are that it is in a finer state of division than Paris Green,

but the application must be three times as strong as Paris Green to get the same results; it also remains longer on the foliage because it does not wash off so easily. Being finer, it will remain in suspension better, and therefore arsenate of lead is, except for the matter of color, rather better than Paris Green. The danger is that in color it resembles other substances in domestic use, and therefore he did not like to recommend it for general use. It is very effective, and the mixture, if of proper strength, is safe in the hands of careful men, but it must be used carefully. It has been placed on the market in a convenient form under the names of Bowker's Disparene and Swift's Arsenate of Lead. It is a very powerful poison and very effective, but on account of the danger I have referred to, I do not recommend it except with the above named provisoes.

Dr. Bethune: I have employed the bandaging system a little and found it very effective indeed in catching the insects. The one great difficulty about bandaging is that it must be properly attended to. If you do not look after the bandages regularly, and at sufficiently short intervals, you are simply providing a most convenient place for the worm to conceal itself in and to change to the chrysalis stage. If the bandages are taken off at least every ten days and the larvae and chrysalids removed from the tree, it is a most effective and useful remedy, and is probably the only really good remedy that we have against the second brood of the codling-worm, with the exception of Mr. Fisher's plan of allowing sheep or pigs to devour the fallen fruit. Where a man has only a few fruit trees, he certainly ought to do that work himself and gather all that falls and destroy it. It is no use to gather a week after it has fallen. The drawback is that of labor and expense. I find that to examine properly a single bandage it takes at least ten minutes, because the larvae hide themselves under bits of loose bark and conceal themselves very thoroughly, and it requires a very good eye to find where the creatures are, so that it all takes time and care. No doubt that labor might be saved to some extent by having some convenient form of scraper which would scrape them off and save this troublesome work. You will, however, find under the bandages a considerable number of the worms they have not had time to conceal themselves, and these you can easily get rid of.

The question of parasites was brought before the Minister of Agriculture for Ontario in consequence of a paragraph in some of the newspapers in which he was credited with having discovered, or having available, a parasite to wipe out the codling-worm. He wrote to me on the subject and asked for information, as he was credited with a great deal more responsibility than he has any desire to have placed upon his shoulders. I told him that it was hardly possible to hope for an effective parasite, because the creature during the greater part of its life was inside the fruit and out of the reach of parasites. The only time for the parasite to attack the insect is during the very short period between the emergence from the egg and the time it is buried away inside the fruit, and then again it might be attacked after it has left the fruit and is proceeding to crawl to some convenient place before changing into a chrysalis. However, at his suggestion, I have been making inquiries both in California and at Washington and expect very soon to have some fuller information.

One other point which has been referred to I should like to emphasize, and that is the usefulness of birds in destroying these insects. A very large number of the larvae are destroyed in the winter time by woodpeckers, creepers and nuthatches. These birds ought to be encouraged in every way. Good work is also done by the chickadees and other birds. The

chickadees may be kept around an orchard or garden by helping them out with a little food during the winter. A good plan is to hang some suet in the trees.

The remedies then for the codling-worm are, first, spraying to get rid of the first brood, which can be exterminated, or nearly so. Spraying at the proper time and in the proper manner, as has been described this afternoon, should be resorted to, and also the removal of all fallen fruit. For the second brood, there is the bandaging. Then, after that come the woodpeckers and other birds. We cannot trust much to parasites, but we may be quite sure that our enterprising Minister of Agriculture will use every effort to bring the parasites, if they are found to be effective, into this country and make use of them here.

Dr. Fletcher said that parasites are not useless by any means. There are internal parasites as well as external parasites, and some of these parasites would be able to reach the worm in the apple. The larvae of the large Pigeon Tremex, which bores deep in the solid wood of maples, is parasitized by the two large Thalessas. There are several parasites which are also able to find out their hosts in the wood of trees. We do not know everything yet about parasites, but we must not say that they will not do this work. There are several parasites of the Codling-worm, as Dr. Brodie has told us, and when we find parasites in large numbers we may expect to obtain some results. To give an instance—one of the striking outbreaks at Ottawa was an aphis on birch trees, which was so abundant that the whole of the tree was covered with a black fungus, growing on the honey dew exuded by the aphis. The insect was abundant in June and July. Then we found that all over these trees affected by the plant aphis there were myriads of lady-bird beetles, and these beetles were so numerous that they wiped out the whole lot of aphis. We found ten to twenty of their pupae on a single birch leaf. What became of all those lady-bird beetles? Perhaps from a branch holding, say 50 leaves, we did not get 50 lady-bird beetles, but got a great many thousands of another parasite, forty to fifty of a little hypo-parasite from a single pupa. Thus nature brings back again the balance by reducing the excessive number of beetles. Where one pupa produced a beetle, forty-nine never produced beetles but produced parasites. We do not know yet what can be effected by a Codling-worm parasite, but we must not give it up as hopeless. It is most hopeful. As Dr. Bethune showed us, though, we must not be too sanguine. With regard to the worms that burrow in the bark beneath the bandages, I find a brush with wire for bristles a convenient instrument for removing them. One was supplied with my furnace and I have made use of it to scrape off the worms on apple trees. Time can be saved with a proper implement, and a wire brush of this kind is good. The codling-worm does not change to a pupa inside its cocoon at once, but remains as a larva until just before it is going to emerge.

Mr. Scott: How do you kill the cocoons in the burlap bandages themselves?

Dr. Fletcher: It is rather a troublesome matter. One man who bandages his trees has at the side of his orchard an India rubber wringing machine and runs them through that, or they may be thrown into scalding water. The burlaps are all taken off into a wheelbarrow and dropped into large open caldron used for sugarmaking; they are taken out at once and put back again. These are the only two methods known to me.

Mr. Nash: I saw a man screw the wringer on the side of the wheelbarrow, and go through the orchard with it.

Dr. Fletcher: Hot water is probably the most effective method of killing the worms.

Mr. Jarvis: Those left on the bandage and pressed, if very numerous, might spoil the bandage.

The hour for closing the discussion on the Codling-worm having arrived, the Chairman thanked those who had taken part in the discussion and called for the reports of the Directors of the respective districts.

REPORTS ON INSECTS OF THE YEAR.

Division No. 1.—Ottawa District. By C. H. Young, Hurdman's Bridge.

The season of 1906 in the Ottawa District was marked by cold, wet weather in the early part and later by an excessive drought. The most noticeable insect feature of the season was the enormous numbers of plant lice which infested every plant. Trees were much reduced in vitality and many complaints were made of the leaves falling prematurely. In going through the woods in July it was almost impossible to collect a good botanical specimen, as the foliage of all low-growing plants was covered conspicuously with the honey-dew emitted by the aphides. The elm-leaf aphis and the maple leaf cottony aphis were particularly abundant. The foliage of many fine maples was noticeably disfigured by this latter insect. Birches also suffered very much from aphis. Some fields of potatoes were badly infested with a plant louse which Dr. Fletcher tells me he thinks is *Nectarophora solanifolia*.

In the early part of the season the usual occurrence of cutworms in gardens was noticed, the species doing the most harm being the Red-backed cutworm (*Paragrotis ochrogaster*) and the Black army-worm *Noctua fennica*. This latter cutworm works particularly in clover fields, but in the Ottawa district clover was winter killed during the open cold winter of 1905-6, and this fact probably accounts for their presence in vegetable gardens this year. Where applied, the poisoned bran mash soon stopped the ravages of these cutworms.

At the time dahlias and asters were coming nicely into flower, the Tarnished Plant-bug was very numerous and did a great deal of damage in destroying the flowers and forming buds. This is a difficult pest to treat. Spraying the plants with kerosene emlusion or whale oil soap or dusting them with pyrethrum insect powder, have given relief, but these remedies are not always satisfactory. In the early morning, when the bugs are not so active, many may be collected by beating them off the plants into an inverted umbrella, and then killing them by putting them into some receptacle containing water and coal oil.

The small white cabbage butterfly was not particularly in evidence in the early part of the season, but the late brood in September was very abundant and hundreds of the butterflies could be observed in some cabbage patches. Where these patches were neglected the green caterpillars soon did noticeable damage.

The Turnip Flea beetle was locally very destructive on a few farms near Ottawa. Some farmers who did not know the well-known remedy of Paris green and land plaster lost two or three sowings.

In asparagus beds, where the plants had been allowed to go to seed, many specimens of the Zebra caterpillar (Fig. 1) were noticed in September and early in October feeding on the leaves. This of course was due to the fine, almost summer weather which we have had this fall in Ottawa.

Among orchard insects the caterpillars of the Codling moth were abundant in orchards which were not sprayed, and later in the season the conspicuous nests of the Fall-Web worm were noticed in many orchards. This latter insect was also very bad in forests, ash, elm and other trees being much defoliated. In orchards these insects are not only destructive, but make the trees very unsightly. The remedy of cutting off the branches bearing the nests when these are small is such an easy one that I cannot understand why owners of good orchards allow this insect to work on their trees. A few colonies of the Red-humped apple tree caterpillar (Fig. 2) and the yellow-necked apple tree caterpillar were observed, but of course these did not do much harm. Cedars everywhere were much disfigured by the small caterpillars of *Argyresthia Thujiella*, a beautiful little white moth with bronzy bars on the wings. These minute larvæ feed on the tips of the shoots, causing them to die and lose their natural color.

I am glad to inform the members of our Society that I have been able to continue my collection of lepidoptera, most of my time being spent in working up our small forms, the micros. The specimens which I have brought with me will, I think, delight some of you. For these small moths the season has been very good at Meach's Lake, where I spent the summer, but speaking generally, I do not think the season was as good as 1905, at least in the Meach's Lake district.

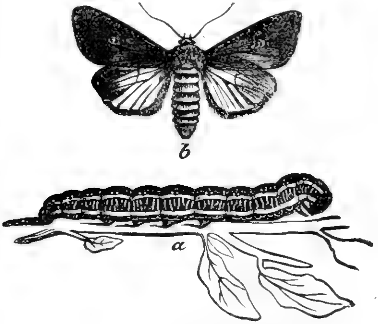


Fig. 1.—(*a*) The Zebra Caterpillar.
(*b*) The Moth (Mamestra picta).

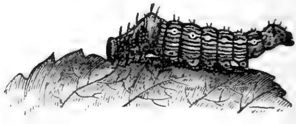


Fig. 2.—The Red-humped Apple Tree Caterpillar (Notodonta concinna).

Division No. 2.—Midland District. By C. E. Grant, Orillia.

Though I have been very busy with town work this year, which has prevented me from doing a great deal with the net, I have observed that most insects have been unusually common; at the same time the rapid growth of vegetation has apparently reduced the destructiveness of some species. The chief complaint made to me in this neighborhood has been with regard to the Buffalo beetle, which has become quite a nuisance here. Dr. Fletcher was kind enough to send to the *Packet* newspaper of Orillia the best methods

of prevention; at the same time there does not seem to be any permanent remedy if you do not close your houses up in the spring time. The cutworms were very abundant and our old stand-bys, the codling moth and onion maggot were, as usual, destructive. The currant sawfly was also abundant this year, though for two years previously I left some bushes unsprayed and they were not at all eaten. Tent caterpillars were not numerous in the spring, but the Fall Webworm was to be seen nearly everywhere in September. The Tussock moths, though common as moths, do not do much harm as far as noticed here. There has been no complaint of the Pea weevil, though I have asked several intelligent farmers of the neighborhood to inform me of their ravages if noticed. Altogether I might say that this district has not been troubled with any serious outbreak of insect pests. Though the season has been an exceptionally fine and warm one, as I said before, I have not been able to give much time to entomology this year, but I have added one more Plusia, also *Harrisimemna trisignata* and *Arsilonche albovenosa* to my collection of local moths. I also have to report the second capture of *Junonia cœnia* in Orillia.

Division No. 3.—Toronto District. By J. B. Williams, Toronto.

The Tussock moth, as usual, did a good deal of damage to the shade trees in Toronto. About the middle of July the caterpillars began to let themselves down from the trees by a thread to the ground, and then ascended the trunks to pupate. Many of them were very small, and had a sickly yellowish look, and made poor little cocoons. Such specimens, I imagine, had been suffering from parasites, and on some trees the proportion of these small cocoons that seemed to come to nothing was very large. I saw a cluster of eggs on August 5th, but there do not seem to me to be as many eggs as usual on the infested trees.

The row of chestnut trees from which I had the cocoons collected last year, had some caterpillars on this year, but they were not nearly so numerous as on some neighboring trees, so that the destruction of the egg masses last year evidently did some good.

Apple trees around Toronto have been a good deal damaged by the Codling moth. In two orchards that I examined, one in the city and one about a mile outside, a very large proportion of the apples had been rendered quite worthless by the ravages of this pest.

I visited Niagara Glen in September, and found the Walking stick insects almost as numerous there as they were two years ago. Several large basswood trees had been completely stripped of their foliage by these creatures, and I noticed a Chestnut oak (*Quercus prinus*) some ten or twelve feet in height, with about two-thirds of its foliage destroyed, but the swarms of Stick insects that were upon it must, in a few days longer, have cleared off every leaf.

Division No. 4.—Hamilton District. By George E. Fisher, Burlington.

In making my report of insect conditions in the Niagara District, which as a Director of the Entomological Society of Ontario I am supposed to represent, I can speak advisedly of my own immediate section and of such particulars as came to my notice during occasional visits to other parts of the district.

The phenomenal increase of the San Jose scale and of the Fall Web-worm and the attack of the Codling worm upon the apple crop, which was unprecedented in severity, were the most conspicuous features of the year.

The Curculio, aphis, potato beetle, asparagus beetle, cabbage worm and a host of others were everywhere present and ready to take advantage of any grower's neglect. Wireworms are making considerable trouble in garden land, and the Spruce Gall-louse is continually cropping up and is now known to be widely distributed. Tent caterpillars and Canker worms were not plentiful.

As our growers understand it, the Wireworms require three or more years to complete their life circle, and are in the pupa stage during the months of August and September, when they are easily destroyed by deep and frequent plowings and cultivation, but unfortunately the gardeners' land at this season is so fully occupied with growing crops as to render such treatment impracticable, and the pest continues.

Opinions differ as to the behaviour of the Spruce Gall-louse and the people are looking to the entomologists to determine its life history and habits definitely and to suggest a remedy. In the meantime they are picking off the galls, spraying and fumigating, thus holding it in check where this was done.

The Asparagus beetle has increased surprisingly. Small beds may be protected by the hen-and-chick method, but in large plantations involving several acres this is scarcely possible. There are instances of the young growth being covered with beetles before reaching marketable size, which disfigure both by gouging into it and by depositing their black eggs in large numbers. In this condition it is valueless.

Asparagus rust is also very troublesome. The only convenient remedy we know of for large blocks is careful and persistent spraying of the growth, after cutting is discontinued, with Bordeaux mixture heavily charged with arsenic, which will reduce both rust and insects. Some of our people have signified their intention to give up the struggle, which is to be regretted, as asparagus is generally appreciated, and under ordinary conditions is a source of considerable revenue to the growers.

Copper sulphate is being much used on potatoes in the form of Bordeaux mixture with arsenic, being first applied immediately after the first hoeing and at regular intervals until about five treatments are given. In this way blight is lessened, the vines retain their leaves, the crop is increased, the quality improved, and the bugs do not at any time become plentiful, for when larvæ are young they eat much more ravenously than they do later on and with less discrimination.

Notwithstanding the pains it takes to advertise its presence, the increase of the Fall Web-worm is very marked indeed, which can be attributed only to careless neglect on the part of the growers.

Grape-rot was prevalent in many sections and the free use of Bordeaux was found to be very effective in controlling it. Four or five treatments are necessary, the first treatment being given before the buds open. Where this early spraying was omitted the rot was much more general, especially on the red and white varieties, which in many instances when not sprayed early showed a waste of from twenty to fifty per cent.

There is no insect so widely distributed and so destructive to the fruit crop of the country as the Codling moth, which causes the loss of many thousands of dollars annually. This was pre-eminently a Codling moth year, the worst on record. In many apple orchards one-half of the crop was wormy,

and in some the proportion of injury was even greater. How to lessen the ravages of the Codling worm is an intricate problem for apple and pear growers who resort to various means. The most popular remedies are spraying with arsenic, bandaging, and keeping hogs and sheep in the orchard. Spraying, to be effective, must be done while the calyx remains open and before the fruit turns down, which will be useful only in reducing the first brood. Bandages should be applied early in June after the rough bark has been scraped from the trunk and large limbs. Being thus deprived of the natural shelter, the larvæ will continue their pilgrimage until they ultimately come to the snug quarters which the bandage affords, where they will remain. If these bandages be removed, and, after the worms have been destroyed, be returned to the tree at intervals of ten days and this be continued throughout the season and until after the crop is harvested, the evil will be materially lessened Notwithstanding the great advantage which is sure to follow, these methods require more time and labor than the average farmer is likely to expend under existing labor conditions. In the Niagara district there are a good many successful apple and pear orchards standing in sod, and the owners unhesitatingly declare in favor of this treatment. Some cultivated formerly, but have abandoned cultivation. Others have part of their orchards in sod and part in cultivation, and say the trees in sod give the best results. They all agree that the grass must be kept pastured off very closely and never be allowed to get much top.

Hogs and sheep are usually kept in these orchards. The advocates of this method claim that their trees bear more regularly, that the fruit is more highly colored, and keeps better than that from cultivated trees, and that they keep the proportion of wormy apples well below ten per cent. I have observed that pruning has been carefully attended to in all successful orchards standing in sod.

I do not wish just yet to be understood as advocating sod in orchards, but have no hesitation in endorsing all of the advantage that is claimed to attend the presence of sheep and hogs. And further, this treatment is easy and much more likely to be conducted to a successful conclusion than either of the methods first mentioned.

Since its introduction into Canada never before did the San Jose scale enjoy conditions so favorable for its increase as were experienced during the past twelve months. The exceptionally mild winter suffered a much larger proportion than is usual to come through alive, and the hot, dry summer furnished ideal weather for rapid multiplication. It is needless to say that the scale made the best possible use of its opportunity and that the increase and spread were much greater than was ever before observed in this country.

This remarkable increase and the effect upon the trees were so easily seen that many growers question the possibility of combatting the scale successfully, and are taking no action. At the same time a few others, who have counted the cost carefully, and considered the advantage of both saving their orchards, and disposing of full crops on bare markets, have used lime and sulphur thoroughly cooked and freely applied for four or five years, with exceedingly gratifying results. These men did not shrink from the necessary expenditure, and besides maintaining their orchards in the highest possible condition of health and vigor, have realized greater net profits from them than they ever did before the advent of the San Jose scale, and this, too, in the midst of infested surroundings.

EVENING SESSION.

Wednesday, October 10th, 1906.

A public meeting was held in the Massey Hall of the Ontario Agricultural College at 8 o'clock, p.m. Notwithstanding the inclemency of the weather, the first snowstorm of the season prevailing at the time, the large hall was nearly filled with an appreciative audience, including many of the students from the College and Macdonald Institute and some visitors from the city of Guelph. The chair was taken by Dr. Fletcher, the Vice-President, who opened the proceedings by congratulating the Society upon its successful removal from London to Guelph, and on the excellent arrangements that have been made for its library and collections by the authorities of the Ontario Agricultural College. He believed that the Society would fully appreciate its new home and find its usefulness was very greatly extended by its being placed in the midst of an enthusiastic band of young men and women students. When these completed their courses of instruction they would scatter all over the country, and carry with them much they had learned through the instrumentality of the Society; many of them, too, would become active members here and continue their connection after they had left He looked forward with confidence to the bright days in store for the Society in which it would fulfil the duties that devolved upon it in a larger measure than ever before.

President Creelman gave a warm and hearty welcome to the Society and expressed the pleasure that he and all connected with the College felt in having its headquarters in their midst. Last year he was proud of the meeting, which was held here at the College, and wished that we might have it every year; now he was glad to say that this had come to pass and that these annual meetings would, as a rule, be always held here. This Ontario Entomological Society is a great Society, not so much in numbers as in the value of the work that it has accomplished, and which it continues to perform. He then spoke of the two systems of education and pointed out the advantages to be obtained from a combination of a knowledge of natural history with a good general education; this he considered much superior to the old-fashioned methods in which the pupil grew up without any knowledge of the common objects in the world about him. The practical value of Entomology to farmers and fruit-growers he did not think could be over-estimated; if put into figures, it would mean nothing below millions of dollars. He was especially gratified that the chairman had described their new quarters as "home," and trusted that it would continue to be their home for many a year to come. He then placed at their disposal everything that the College could offer for their comfort and convenience, and trusted that the meeting would be both profitable and enjoyable.

The chairman then called upon Mr. John D. Evans, of Trenton, the President of the Entomological Society, to read his address. This was followed by a paper by Prof. Lochhead, of Macdonald College, Ste. Anne de Bellevue, P.Q., on "What the Entomological Society of Ontario can do for the Ontario Agricultural College." In the absence of the writer, who was unavoidably prevented from being present, the paper was read by Prof. McCready. Mr. Paul Hahn, of Toronto, then gave a description of a canoe trip for entomological purposes in the Algonquin Park, and illustrated his remarks with a number of beautiful and interesting lantern slides made from his original photographs. A hearty vote of thanks was given to Mr. Hahn for his entertaining address. The proceedings of the evening were much enlivened by musical selections, both vocal and instrumental, furnished by the College Philharmonic Society.

ANNUAL ADDRESS OF THE PRESIDENT.

By John D. Evans, C.E., Trenton.

When at the annual meeting of a year ago I referred in my address to its being the first meeting held at the fountain-head of Economic Entomology for the Province, little did we surmise that this noble Institution, the Ontario Agricultural College, would so soon become the headquarters of the Society.

We extended a hearty welcome on that occasion to Prof. Franklin Sherman on his accession to the duties of Entomologist, etc., on the staff of the Ontario Agricultural College on the retirement of his most worthy predecessor, Prof. Wm. Lochhead, but we little thought that his time with us would be so brief; but no doubt he was sadly missed in his old haunts, and rejoicings were much in evidence when he returned to his former position.

During his, Prof. Sherman's, short term of office he infused fresh blood into matters entomological and laid the foundation for a more complete and thorough system of collecting and maintaining a collection at the College of the Insect fauna of Ontario.

Upon the retirement of Prof. Sherman, who could be found as his successor more worthy or capable of undertaking the duties of Entomologist for the college than our most highly esteemed Editor, Librarian and Curator, Rev. Dr. C. J. S. Bethune, one of, if not the father, of Entomology in Ontario. When this matter was settled it became a most serious consideration for the welfare of this society into whose hands could be placed the care of the Library and collections. No one resident in London could be found who had the leisure and knowledge necessary for the proper performance of the duties inherent to the circumstnaces. It was suggested that a transfer of the Society's library and collections be made to Guelph, where accomodations for the same and the business of the Society would be provided by O. A. College authorities, rent free, and no change be necesasry in the office of Librarian and Curator.

Some of the local (London) members of Council were adverse to the proposed change, suggesting that the transfer should be made to the Normal School in London, but others of the members being otherwise minded it was proposed to take a vote of all the members of the Council. Towards this end a circular letter was issued on the 4th day of May and ultimately replies were received from all the members when the vote stood *eleven* for the removal to Guelph and *four* against it; one member declining to vote, but suggested to lay the matter over until the Annual Meeting.

As the matter stood nearly three to one in favor of the removal, the undertaking was carried out during the month of August last without accident or mishap of any kind, and the Library and collections are now installed in their new, commodious and most desirable quarters, where they will be of inestimable value, not only to the students attending the college from year to year, but to all investigators of Economic Entomology, the College being the head centre, as it were, of that department in the Province, and where they will naturally congregate and look for assistance and inspiration.

Under the present conditions the usefulness of the Society will no doubt be greatly extended. It is hoped for and trusted that the number of members will be greatly increased through the instrumentality of the precincts of the

O. A. College, and a goodly number of the names added from year to year will continue on as active members long after they have severed their close connection with the College and drifted off to the four quarters of the globe.

An agreement has been entered into by and between the O. A. College and the Entomological Society of Ontario whereby the College provides ample accommodation for the Society's Library, Collections and business requirements, free of rent and completely under its own control in every respect, and subject to the withdrawal of the same by the Society at any time they may be disposed to do so.

This present occasion is the Forty-Third Annual Meeting of the Society. During all these long years this occurrence has come around regularly and without a break.

It was in 1863 (quoting from Rev. Dr. Bethune's "Rise and Progress of Entomology in Canada," printed in the Transactions of the Royal Society of Canada and read May 26th, 1898,) that the Society had its inception at a meeting held in Toronto at the residence of Prof. Croft.

In 1872 the headquarters were moved to London, Ont., where it has remained up to the present year. It is with feelings of great regret that we have to renounce old associations of such long standing, but a change was imperatively necessary.. It is hoped and expected that the move recently made will give a fresh impetus to the good works performed by the Society in the past and that it will now enter upon a new lease of life with its range of possibilities greatly augmented.

The quantity of new literature issued during the past year has been quite up to the standard. Not only the usual number of periodicals, magazines and reports of State, Federal and Provincial authorities have been regularly issued, but reference might be made to several new books, notably a new work on "Entomology," with special reference to its Biological and Economic aspects, by Dr. Justus Watson Folsom, in which are numerous illustrations, many of them being entirely new and of a high grade.

Also "A Glossary of terms used in Entomology," by Dr. John B. Smith, a much needed work which will prove of great service to very many entomologists.

We must all deplore the great destruction of property and loss of life occasioned by the appalling earthquake and fire in San Francisco in the early part of the year and express our heart-felt sympathy with the rescued and sufferers. This, no doubt, has been the occasion of the most extensive and irreparable loss the world has ever known of both private and public collections of Insects and of Libraries relating to the same.

The season of 1906 has been an unusual one. The winter was extremely mild, especially the months of January and February, with a very light snow fall. This was followed by a very dry, cold backward spring and a very wet June; July, August and September being noted for the excessively hot and unusually dry weather.

Insect depredations, so far as I have been able to ascertain, have been but slight or of little consequence. The pea-weevil has not given any trouble. Numerous instances of the nests of the Fall-web worm, *Hyphantria cunea*, Dru., have been observed on apple, elm and other trees, but no serious injury done.

In the vicinity of Frankford a number of cases occurred where isolated oak trees had been completely defoliated, caused probably by the Forest Caterpillar, *Malacosoma disstria*, Hub. Attempts were made to procure some of the insects, but too late; it was reported that they had died in large numbers, but from what cause could not be ascertained.

For some years past in several portions of the United States, notably New York State and New Jersey, also in Cuba, a war of extermination has been declared against the Mosquitoes by draining marshes and pools and also by covering stagnant water with a thin coating of petroleum, but now the fight is being carried to our own shores, for quite recently Mr. Henry. C. Weeks, Secretary of the American Society for the Extermination of the Mosquito, has been invited to Toronto to discuss and advise with those interested as to the best means of combatting the evil on Toronto Island.

WHAT THE ONTARIO ENTOMOLOGICAL SOCIETY CAN DO FOR THE ONTARIO AGRICULTURAL COLLEGE.

By William Lochhead, Macdonald College, Ste. Anne de Bellevue, P.Q.

The removal of the headquarters of the Ontario Entomological Society to the Ontario Agricultural College is now an accomplished fact; and whether it was a wise move or not remains to be proven by the accomplishment of better work. I must, however, congratulate the O. A. C. on the new relationship, for I see many advantages that will come by the transfer to the College, and especially to the Entomological Department.

First of all, the Entomological Society of Ontario has won a reputation that is almost world wide; it is well and favorably known wherever insect life is studied. Its publications are valued by every Entomological investigator of note, and the best workers of North America contribute regularly to the pages of the *Canadian Entomologist*. For 43 years our Society has been in active existence, and the influence it has exerted during all these years on the progress of Entomology and education along Nature-Study lines in Canada has been very great and can scarcely be estimated.

For 43 years Dr. Bethune has stuck to the ship, and under his careful guidance the shoals and rocks and bars have been successfully passed. All honor to the men who have been associated with him for many years, viz., Dr. Saunders, Dr. Fletcher, Dr. Fyles, Mr. Lyman, Mr. Harrington and our President, Mr. Evans, for their most valuable and voluntary assistance. For 43 years the Ontario Entomological Society by means of its annual reports and special popular lectures has been educating the rank and file of the people into a knowledge of insect life.

I believe, therefore, that the transfer to the O. A. C. of the headquarters of a Society such as ours, which has done so much for Entomology the world over, will give an impetus to the study of insects at the College, and the Entomological Department at the O. A. C. will become better known on account of its intimate connection with the Entomological Society.

Again, the Ontario Entomological Society has all along been known as a great educational agency. It has taken the lead in educating the public as to the life histories of the injurious insects and the best means of controlling these insects. It has also done much to foster the Nature-Study Movement which means so much for the children. With its home at the centre of the agricultural education of the Province the Entomological Society and Entomological Department will be able to co-operate more effectively than was possible in the past. I look for a great forward movement in educational lines under the new arrangement.

Under the new partnership the Ontario Agricultural College can furnish the facilities and means of doing work, viz., its laboratories, insectary and funds for travelling. The Entomological Society can furnish the men and influence. The members of the Society scattered through the Province can be brought more closely into touch with the work of the Society and the Department. Their energies can be directed to better advantage by the central agency, Dr. Bethune and his assistants; and the season's observations will, therefore, be more definite and hence more valuable.

As you all know, the Ontario Department of Agriculture publishes and distributes for the Society its annual report which contains the papers prepared by its members. This report is edited by Dr. Bethune, and is printed early in the New Year, so that the recommendations made by the members may be of service to the fruit-grower and farmer the following year. Moreover, the records and observations which are often of great value, are distributed promptly to brother observers all over the world. Now the Entomological Department, with its head as Editor of the Annual Report, is happily situated in that it can place on record before the scientific world its observations of the year.

What an incentive to ambitious students to make careful observations during the summer holidays on their farms! No other Department at the College has such facilities at its disposal for the immediate publication of scattered records and observations which could not well be published in bulletin form.

Again, the Entomological Society brings to Guelph its large collections of insects which have been carefully looked after for many years. The specimens in the collection are valuable in that they represent Canadian forms mainly, and many are types of new species described in the *Canadian Entomologist*. The specimens have been carefully named by specialists, and are thus simply invaluable for purposes of reference. These collections now become, therefore, part of the collection of the Entomological Department and are at the service of that Department for research and lecture work. Advanced students and specialists in systematic Entomology will soon appreciate the worth of such collections when they undertake the study of special groups of insects. For many years the College had but a meagre reference collection, which condition of affairs rendered the work of instruction extremely arduous and time-consuming. Students outside of the College will no doubt be encouraged to send in specimens for identification and for help; and every outsider helped increases the reach and influence of the College.

Again, the Entomological Society's library, which also comes to the O. A. C., is one of the best specialists' libraries in Canada, or the United States for that matter. It contains an unusual large number of full sets of entomological journals obtained mainly by exchange with the *Canadian Entomologist* during the 37 years of its publication. Besides these, the library contains nearly all the Entomological publications—in English, at any rate—of the last 40 years.

For research and advanced work all the books and journals are at the disposal of the students and staff. Without them the staff was formerly much handicapped for lack of literature dealing with special groups of insects.

Connected as I was with the Entomological department of the O. A. C. for many years, and having labored hard under difficulties that are now largely removed by the transfer of the headquarters of the Entomological Society to the Entomological department of the O. A. C., I feel envious

of Dr. Bethune and Mr. Jarvis, especially when I see the opportunities for work that they now have. When I take a backward look over my own early work here and contrast the meagre facilities I had at my disposal, with the splendid equipment of books, collections, laboratories and insectary that are now at the disposal of the Entomological department, I am constrained to exclaim, "How the times have changed!" But while I envy Dr. Bethune, I must congratulate him and the College on the present happy state of things, and may he live long to enjoy the work that he has so much at heart! May the Agricultural Department and President Creelman continue their generous treatment of a Department that is now in such an excellent position to do much for the Province!

SECOND DAY'S SESSION.

Thursday, October 11th, 1906.

The Vice-President, Dr. Fletcher, took the chair at 10 o'clock in the Biological lecture room of the Ontario Agricultural College. There were present throughout the day a large number of students from both the College and the Macdonald Institute, in addition to the members of the Society. The first order of business was the reading of the reports of the Council, the Branches of the Society at Montreal, Quebec, Toronto, Guelph and British Columbia, and of the Treasurer, Librarian and Curator, and the Delegate to the Royal Society. This was followed by a debate on the San José Scale.

SAN JOSE SCALE.

Mr. J. Fred Smith, San José Scale Inspector for the Province of Ontario, was commissioned by the Department of Agriculture to bring before this meeting of the Society the prevalence of the scale on fruit exposed for sale in Toronto and elsewhere, and the question whether this might prove to be a menace to sections of the country where the scale did not already exist. In his opinion the danger is not very great, as the fruit, when consumed, is peeled and the rinds which bear the scales are thrown into the domestic receptacles for garbage, and thus the scales are destroyed without any opportunity of spreading to trees. The larvae cannot live long without food and when the rind is removed from fruit, it quickly dries up and the supply of liquid food for the insect no longer exists. He thought, however, that if the sale of scale-infested fruit was forbidden, it would compel the growers to take more trouble to keep their trees free from it. He considered that the scale was not spreading much, but where it did occur it was becoming a very serious danger to the orchards. In small centres of infestation it could be exterminated, and those interested should use every means in their power to get rid of it. It had recently spread to Font Hill and would no doubt spread further about the different centres if not properly dealt with. He exhibited a number of specimens of apples and pears more or less encrusted with the scale.

Mr. T. D. Jarvis said that he had found the scale on trees in private grounds in Toronto, and was of the opinion that the scale must have been introduced on fruit. At the time of the Exhibition three years ago he found

that 75 per cent. of the fruit brought into Toronto that came under his observation was affected with scale. The consumers of the fruit throw out the peelings and the insects may thus be enabled to reach near-by trees, especially through the agency of sparrows and other birds. He noticed that the apples sold by Italians in the streets of Toronto were badly covered with scales.

Dr. Fletcher contended that there was no danger of an introduction of the insect by means of scaly fruit, as the peel to which it is attached would soon lose its moisture and the insect would die from want of food. To be successful, the skin of the fruit must remain moist enough to sustain the life of the insect; the female must be ready to produce her young; and the young must be able to reach a fruit tree—a combination of difficulties which it would be hard to overcome and which rendered infestation by this means extremely improbable, if not impossible. He did not think that many people would buy scaly fruit, and a grower would not venture to sell it, if he valued his reputation. He considered that it would be unjust and wrong to legislate against the sale of scaly fruit and thus injure a vast and most important industry.

Mr. Caesar stated that the scales were sometimes carried by ants, and as ants were often attracted to fruit peelings, they might easily be the means of transporting them to trees. Scales were sometimes attached to lady-bird beetles also.

Dr. Fletcher said that in Germany and in the United States there had been legislative enactments forbidding the sale of any fruit infested with scales, and much inconvenience and loss had been inflicted without any compensating advantage. He considered that it would be wrong to legislate against the sale of such fruit until we are quite sure that such restrictions are necessary to prevent the spread of the insect. We must not be alarmists and magnify the danger; the infested localities in Ontario are few and small, and the spread of the scale is not by any means rapid.

After some further discussion, in which others took part, the opinion of the meeting at the close of the debate was unanimous that it would not do at the present time to make any stringent regulations forbidding the sale of scale-infested fruit and thus hamper a very important industry. As there is so much doubt and difference of opinion regarding the danger from it, and our information is so limited, it would be unwise to frame any regulations till we are quite sure of the dangers to be guarded against. It was thought highly advisable that an inspection should be made of infested trees in Toronto and the origin of the scale upon them traced as far as possible. Young trees might have come from infested nurseries, but old trees, if attacked, must have received the insect in some other way.

The rest of the morning was occupied with the reading of a paper by Mr. Lyman on "A Search for a Borer," and an address on Gall Insects by Mr. Jarvis. The latter was illustrated by a large number of original lantern pictures and a profusion of specimens of a great variety of galls.

In the afternoon the remainder of the papers on the programme were read; they will be found in subsequent pages of this report. The election of officers for the ensuing year, 1906-7, was proceeded with and resulted as shewn on page 2.

The following exhibits of specimens were made by members during the meetings and attracted much attention:

By Mr. J. D. Evans.—A series of *Eucosma Scudderiana*, with parasites and super-parasites; some interesting Noctuids, and a species of Saw-fly which had been found injuring Virginia Creepers.

By Dr. James Fletcher.—Some remarkable forms of *Colias philodice* taken at Digby, Nova Scotia, by Mr. J. Russell, together with *C. interior*, *Grapta satyrus-marsyas*, *Thecla irus* and *T. læta*, also taken at Digby by Mr. Russell. A pair of *Cœnonympha kodiak* and *Erebia Magdalena* taken in the Yukon by Mr. Jos. Keele of Ottawa. Specimens of two species of wasps, *Vespa borealis* and *V. diabolica* which were reared at Ottawa from the same nest on three separate occasions. An interesting photograph of the webs made by the larvæ of *Ellopia somniaria* at Victoria, B. C., sent by Mr. E. A. Carew-Gibson.

By Mr. Arthur Gibson.—Living larvæ of *Cicindela repanda* and specimens of the Bean-weevil, *Bruchus obtectus*. Also some specimens of rare caterpillars inflated and larvæ of *Œdemasia concinna* parasitized by *Limnaria Guignardi*, which has been very abundant this year.

By Mr. Paul Hahn.—Two cases of Lepidoptera taken in the Algonquin Park, Ontario, and a fine specimen of the tropical moth, *Thysania zenobia*, captured at Toronto.

By Mr. C. W. Nash.—Some specimens of Lepidoptera, including the Burdock-borer, *Papaipema cataphracta*.

By Mr. H. H. Lyman.—Two interesting cases of Lepidoptera, including some rare forms of micros, and specimens of *Gortyna appassionata*, *Grapta satyrus* and *marsyas*, *faunus* and *gracilis;* also a specimen of G. *satyrus* almost identical with the insect figured by Mr. W. G. Wright as *Grapta chrysoptera*, in his Butterflies of the West Coast of the United States.

By Mr. J. B. Williams.—Two living larvæ of *Ecpantheria deflorata*, which he had found feeding on violets in Niagara Glen, Ontario.

By Mr. C. H. Young.—A large case containing over a thousand specimens of Micro-lepidoptera, most exquisitely prepared for exhibition; the majority of the species included have been studied by Mr. W. D. Kearfott. Also a similar case containing many life-histories of rare Noctuids and other Lepidoptera; among them was a fine series of *Papaipema appassionata* and *P. Harrisii*, var., with larvæ; the former was reared from Pitcher-plant, and the latter from *Pteris aquilina*.

By Prof. Bethune.—The life-histories of the two asparagus beetles, *Crioceris asparagi* and *12-punctata*.

By Mr. T. D. Jarvis.—Several hundreds of examples of Galls on leaves, twigs, etc., in illustration of his paper.

By Mr. E. J. Zavitz.—A number of insects affecting Forest-trees.

At the close of the meeting a very hearty vote of thanks to President Creelman for his kindness in providing every facility for carrying on the sessions in the College buildings was unanimously adopted.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its report for the year 1905-6.

The forty-second annual meeting of the Society was held, by kind invitation of President Creelman, at the Ontario Agricultural College, Guelph, on the 18th and 19th of October, and was attended by a large number of the students as well as by many members from a distance. The Society was also favored with the presence of Professor J. B. Smith, State Entomologist of New Jersey, a distinguished entomologist and an honorary member of the Society, and of Mr. C. C. James, Deputy Minister of Agriculture for Ontario.

During the first afternoon the reports of the directors on the noteworthy insects of the year in their respective divisions were read and discussed; papers were also presented by Dr. Fyles and Mr. H. H. Lyman on the Tussock Moth; by Prof. Sherman on Entomological conditions in North Carolina, and by Prof. Lochhead on the experiments made during the year against San José scale.

In the evening a public meeting was held in the Massey Hall at the College and was largely attended. Addresses of welcome were given by President Creelman and Mr. B. Barlow, representing the Wellington Field Naturalist Club. These were followed by a very interesting account of the Mosquito work in New Jersey, illustrated with a large number of lantern slides from original photographs and drawings, by Prof. J. B. Smith. The second day was occupied with the election of officers and the reading of reports from the branches, as well as a number of papers on a variety of important entomological subjects.

The 36th Annual Report on economic and general Entomology was duly presented to the Legislature of Ontario, and was printed and distributed at the beginning of February—a much earlier date than usual. It contained 143 pages, illustrated with 74 figures in the text, and contained in addition to the papers already referred to, the following articles: "Insects as Nature Studies," by Prof. McCready; "Forest Insects" and "The advantages and disadvantages of the Canadian Entomologist," by Dr. Fyles; "Orthoptera and Odonata from Algonquin Park," by Mr. E. M. Walker; "Butterfly Collecting in Canada," by Mrs. Nicholl; "Insects Injurious to Canadian Crops in 1905," and the important "Entomological Record for 1905," by Dr. Fletcher; "Injurious Insects of the Flower Garden," by Mr. A. Gibson; "Forest Entomology," by Mr. E. J. Zavitz. "The Phlox Mite," the "Blue Spruce Saw-fly," and the "Bumble-bees that Fertilize the Red Clover," by Mr. T. D. Jarvis; "Injurious Insects of 1905 in Ontario," by Prof. Lochhead; a similar paper by Dr. Fletcher; and "Notes on the Season of 1905," by Mr. C. Stevenson.

The Canadian Entomologist, the monthly magazine of the Society, has been regularly issued. The 37th annual volume was completed in December last and ten numbers of volume 38 have now been published. The volume for 1905 consisted of 427 pages and was illustrated with seven full-page plates, one of which was coloured, and 29 figures from original drawings. The contributors numbered 62 and included writers in Canada, the United States, England, Jamaica, and the Hawaiian and Philippine Islands. The articles are largely scientific and include descriptions of ten new genera and 161 new species and varieties. There is also a series of articles on "Popular and Practical Entomology," which render the magazine more interesting to those who have not yet entered upon a systematic study of insects. It is hoped that more of those competent to write will assist in maintaining this department of the magazine.

During the winter months fortnightly meetings were held in the Society's room at London, at which a variety of addresses were given on popular scientific subjects. The attendance was not as large as might have been expected in a city with such a considerable population and the seat of a university.

The reports from the Branches of the Society at Montreal, Quebec, Toronto, British Columbia and Guelph are highly satisfactory and show much enthusiastic work on the part of the members.

At a meeting of delegates from the various Entomological Societies of the United States and Canada, held at Cornell University during the summer session of the American Association for the Advancement of Science,

our Society was represented by the Rev. Dr. Bethune. Measures were then taken for the formation of a general society to include entomologists of every grade in North America, and a preliminary constitution was drawn up which will be submitted to a meeting to be held in New York during Christmas week.

The most important event of the year as regards our Society was the removal of the headquarters from London to Guelph. Early in May, the President, Mr. J. D. Evans, sent a circular letter to all the members of the Council setting forth the reasons which led to the proposed removal and asking for their opinions on the subject. In a second letter, dated June 18th, he announced that he had received replies from all the members of the Council and that the vote stood in favor of the removal, eleven, and opposed to it four—one member abstaining from voting. He therefore declared that, as the vote in favor of the move was nearly three to one, the decision for the removal to Guelph was carried.

The Society's lease of its room in the Public Library building at London terminated its second year on the 1st of September, and another tenant was prepared to take over the premises at that date and relieve the Society of the remainder of its term of occupancy under the lease. It became necessary, therefore, to carry out the removal before the end of August. The books and collections forming our Library and Museum were carefully packed and brought to Guelph, and are now placed in their new quarters in the Library and Biological Buildings of the Agricultural College. The cabinets with their contents received no injury whatever in transit and are now conveniently arranged for reference in a part of the College Museum assigned solely to them. The Society's books and other printed matter are in a series of stacks in the fire-proof Massey Hall Library building and are kept entirely distinct from those belonging to the College. All the property of the Society continues to be under the control of its own officers and subject to any regulations that they may adopt. A written agreement to this effect between the College and the Society has been executed and a copy is appended herewith.

Much regret is felt by all the members of the Council, and no doubt by the members of the Society in general, that the headquarters should be removed from London, where they were established in 1872. Unfortunately, interest in entomology has almost entirely died out in London, and there seemed to be no one there available for the supervision and care of the library and collections. The sections also of Botany, Ornithology, Geology and Microscopy had, one after the other, ceased their active operations, and no meetings of any of them have been held during the last two years. Under these circumstances, it seemed to the majority of the Council that a change was imperative, and that a removal to Guelph would be in the best interests of the Society, as well as in accordance with the wishes of the Ontario Department of Agriculture. There is already in Guelph a flourishing branch of the Society with a large and active list of members. During the second and third years of the College course attendance at lectures in Entomology is compulsory, and in the fourth year some of the students specialize in the subject and make it a serious and scientific study—these naturally become active members of the Society and will continue their connection with it after they leave the College and scatter over the country. There will also be at Guelph a continuity of work and interest through the permanent staff of a Professor and Lecturer. The books and specimens will be much more largely consulted and the usefulness of the Society greatly extended. It is therefore believed that the removal, which has lately been effected, will conduce to the best interests of the Society.

The Council wishes to put on record its great gratification that one of the oldest and most highly esteemed members of the Society, the Rev. Dr. C. J. S. Bethune, has been appointed to the important position of Professor of Entomology at the Ontario Agricultural College. Dr. Bethune's wide knowledge of entomology and his long experience in teaching fit him eminently to fill this chair, with honour to himself and great advantage to all students who may attend his lectures. Special arrangements have been made with the Government and the President of the College, by which Dr. Bethune's services will be continued to the Entomological Society in the general supervision of its Library and in editing *The Canadian Entomologist.*

It is with much regret that the Council has to record the death of Baron C. R. Von Osten Sacken, one of our earliest honorary members, which took place at Heidelberg, Germany, on the 20th of May. This eminent Dipterist was born at St. Petersburg on the 21st of August, 1828, and for many years was attached to the Russian Embassy in Washington and afterwards was Consul General for Russia in New York. During the twenty-one years that he spent in America he prepared and published a number of works on the Diptera, and to him is due entirely the first scientific knowledge of the North American species belonging to this great order of insects.

We have also to deplore the loss of one of our oldest London members, Mr. Benjamin Green, who for many years took a deep interest in the Society and was a regular attendant at the meetings of the Geological Section. Though prevented by failing eyesight from doing any active work of late years, his interest in science continued unabated and he kept up his connection with the Society to the end.

John D. Evans, President.

MEMORANDUM OF AGREEMENT BETWEEN THE ONTARIO AGRICULTURAL COLLEGE AND THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Ontario Agricultural College, in consideration of the removal of the headquarters of the Entomological Society of Ontario, together with the Society's library and collections, from London to Guelph, hereby agrees to provide the Society with a separate section of the stacks in the Massey Hall building, for its library, and a room in one of its buildings for the Society's collections and other property; the books and collections, etc., of the Society are to be entirely under the control of the officers of the Society and to continue to be its separate property; they shall also be subject to any regulations that its council may draw up.

The College will provide this accommodation free of any charge for rent or supervision.

The Society shall be at liberty to withdraw from this arrangement and to remove its property at any time, on giving to the President of the College three months' notice of its intention to do so.

Dated this 6th day of August, 1906.

(Signed) G. C. Creelman,
President, for the College.

John D. Evans,
President of the Entomological
Society of Ontario.

ANNUAL REPORT OF THE MONTREAL BRANCH.

The 275th regular, and 33rd annual meeting, of the Montreal Branch was held at the residence of Mr. A. E. Norris, on May 14th, the following members being present: A. E. Norris, in the chair; H. H. Lyman, G. A. Moore, E. C. Barwick, G. R. Southee, G. Chagnon, A Denny, A. F. Winn.

The minutes of the April meeting were read and confirmed.

The secretary read the following report of the Council:—

In submitting their report for the season 1905-06, the Council have pleasure in recording that not only has there been a continued interest in our meetings, but also that there is a growing desire in many directions for accurate knowledge of the habits of insects.

Meetings have been held monthly as usual from October to May, with an average attendance of nine, at the residences of various members. During the summer field-days were held on May 24th and July 1st at St. Hilaire, and Saturday afternoon outings were arranged for, but weather conditions interfered with most of these, and it is to be hoped that the field-day committee will arrange for similar short trips this summer, and invite all interested in natural history to join with us. The branch attended the Natural History Society picnic at Mount Johnson on June 10th, and presented the books for prizes in the Entomological Department, Mr. E. Denny capturing the first prize and Mr. Stevenson the second.

One new member has been added to our roll, Mr. G. M. Stewart, formerly of the Toronto Branch.

The following papers were read at the meetings:—

A Talk on Butterflies and Moths, A. E. Norris.
The Cotton-worm Moth (A. argillacea), A. F. Winn.
Difference between the Sexes in Hemiptera, G. A. Moore.
A Rare Longicorn (Pachyta rugipennis), G. Chagnon.
Hemiptera having Rudimentary Wings, G. A. Moore.
The Tussock Moth Situation in Montreal, H. H. Lyman.
Notes on the Geometridae of Biddeford, Maine, A. F. Winn.
An Account of the Annual Meeting at Guelph, H. H. Lyman.
The Buck Moth (H. Maia), A. F. Winn.
Wings of Hemiptera-Heteroptera, G. A. Moore.
An Interesting Variety of Lina Scripta, G. Chagnon.
Heads of Hemiptera, G. A. Moore.
North American Theclinæ, H. H. Lyman.
Theclas of Great Britain and Ireland, L. Gibb.
Canadian Theclas, A. F. Winn.
The Deaths-Head Moth, Rev. Dr. Fyles.
Notes on some Micro-Lepidoptera, A. F. Winn.
Catocala Relicta, A. F. Winn.
A Hunt for a Borer, H. H. Lyman.
Notes on Apantesis Vittata, E. Denny.

But few additions have been made to the cabinet during the past seasons, and good specimens in any order will be very acceptable.

Mr. Moore has entered up in the Catalogue of Montreal Insects a list of Hemiptera known by him to occur here, making a useful addition.

A beginning has been made in forming a collection of portraits of our members, past and present, and those who have not already handed in their photos are again respectfully requested to do so.

The library has been added to by the receipt of the Reports from New York State, and also the Volumes of the Canadian Entomologist, which have been bound.

At the annual meeting at Guelph, the Branch was represented by Mr. Lyman, and Mr. Winn was elected as this year's delegate to the Royal Society of Canada.

The treasurer's report, submitted herewith, shows a balance to our credit of $49.36.

Respectfully submitted on behalf of the Council,

A. E. Norris, President.

The reports of the treasurer and of the curator and librarian were then submitted and adopted.

The following officers were elected for the ensuing year:—

President—Geo. A. Moore.

Vice-President—E. C. Barwick.

Sec'y.-Treas.—A. F. Winn.

Curator and Librarian—L. Gibb.

Council—G. Chagnon, H. H. Lyman, G. R. Southee and E. Denny.

REPORT OF THE QUEBEC BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The ninth annual meeting of the Quebec Branch of the Entomological Society of Ontario was held at the house of the President on the 13th day of October, 1906.

There were present: The Rev. Dr. Fyles in the chair, Mrs. Fyles, Mrs. J. H. Simmons, Miss Fyles, Miss Bickell, Miss M. Johnstone, Miss Freeman, Miss Hamel, Mr. J. H. Simmons, Lt.-Colonel Lindsay, secretary-treasurer, and two guests.

Dr. Fyles congratulated the members on their re-assembling after the summer holidays. He then told of an excursion he had made through the border townships in the tracks of the Larch saw-fly, *Nematus Erichsonii*, Hartig. He learned that in all that section of the country there was not a first-growth tamarack remaining, and that most of the tamarack of a later growth were destroyed. A few young trees of the kind were growing in places; but a new growth of balsam, poplar, spruce and birch, varying with the nature of the soil, was occupying the broad stretches of land in which the tamarack formerly flourished.

Dr. Fyles exhibited a fine nest of the wasp *Vespa arenaria*, Fabr., which he had brought from the grounds of Mr. George Ramsay, of Little Village, P.Q. It had been built in an open field an inch or so from the ground and was supported by a few stout bents of grass and a small stem of *Aster cordifolius*, L. It resembled a round stone or a large puff-ball, and it contained a surprisingly large number of cells.

While he was examining it at Mr. Ramsay's residence, a fine female—the last of its occupants—burst from her cell and was quickly transferred to the cyanide bottle. This was on the 9th of September. The insect was a beautiful object, jet black with pure white markings; but when it was set up it soon lost much of its beauty: it had become greasy, saturated with oily matter. As the accumulated fat of the bear is its support through its long winter repose, so, probably, this super-abundance of oil in the female wasp is the provision of the insect until the opening spring.

Numerous insects taken by Miss Freeman at her country place at Lorette, P.Q., were also shown. Among them *Tropæa Luna*, L., *Autographa rectangula*, Kirby, *Catocala Briseis*, Edwards, and the handsome beetle, *Chalcophora Virginiensis*, Drury.

Miss Freeman discovered in an unoccupied room—one of the windows of which had been left partly open for ventilation—about a dozen specimens of the beautiful butterfly, *Eugonia j album*, Bois and Le Conte. They had evidently flocked to the room as to a safe refuge from winter storms.

The President exhibited seed of the larger Lady's slipper, *Cypripedium pubescens*, which had come to perfection in his garden. They were contained in a ribbed fusiform pod. To the naked eye they resembled brown dust, but under the microscope they presented a very interesting appearance. Each minute brown seed was attached to the inside of a finely reticulated transparent spindle-shaped capsule, which could be readily carried by the wind, and by this provision the seeds on escaping from the pod are widely scattered.

Lt.-Colonel Lindsay then gave a most interesting account of the Caddis fly frequenting lakes and streams. These flies are very abundant in August and not only the trout are eager to make them their prey, but insectivorous birds gather them with the same intent, so that between the crop of the bird and the maw of the fish—its Scylla and Charybdis—the unlucky insect finds it difficult to steer its course.

The officers for the coming year were then elected as follows: President, the Rev. Dr. Fyles, F.L.S.; Vice-President, Mrs. Richard Turner; Secretary-Treasurer, Lt.-Colonel Crawford Lindsay: Council, Hon. Richard Turner, J. H. Simmons, Esq., Miss Bickell, Miss Freeman, Miss Hedge.

A vote of thanks to the officers, to the hostess of the occasion, and to the authorities of Morrin College for allowing the Society the use of its rooms for its meetings, proposed by Mr. J. H. Simmons, and carried unanimously, brought the proceedings of a very pleasant meeting to a close.

CRAWFORD LINDSAY,
Sec.-Treasurer.

REPORT OF THE COUNCIL.

The Branch now numbers 29 members.

The Secretary-Treasurer's report will be submitted to you and will no doubt be found satisfactory.

In the course of the year, four papers on Ants and one on Aphides were read by the Rev. W. W. McCuaig, and papers on the Tussock and Gypsy moths, European butterflies, Paper-making wasps, the Death's Head moth, and the Arctiadæ of the Province of Quebec, by the President.

The Council regret the departure of Rev. Mr. McCuaig from this part of the country. A vote to that effect was adopted by the Branch.

Our thanks are due to the authorities of Morrin College for having continued to allow us the use of their rooms for our meetings.

CRAWFORD LINDSAY,
Sec.-Treasurer.

REPORT OF THE TORONTO BRANCH, 1905-6.

The tenth annual meeting of the Toronto Branch of the Entomological Society was held in the Provincial Museum on June 19, 1906.

The President, Dr. Brodie, was in the chair, and the following were present: Mr. J. B. Williams, Mr. P. Hahn, Mr. H. S. Saunders, Dr. Abbott, Mr. A. Cosens, Mr. Fraser, Miss Mosey, Miss Blackmore, and a number of visitors.

The following officers were elected:

President—Dr. Brodie.

Vice-President—Mr. Paul Hahn.

Secretary-Treasurer—Miss Blackmore.

Librarian and Curator—Mr. J. B. Williams.

Council—Mr. Ivy, Mr. Webb, Dr. Abbott, Mr. R. Hallam.

The Secretary read the following report:

Your Secretary takes pleasure in announcing a successful and profitable season's work. In all, eight meetings in the Museum have been held, and three excursions thoroughly enjoyed by those fortunate enough to be able to attend. The average attendance at the meetings was 10.

Many very instructive papers were read, particularly those of Dr. Brodie require mention, which dealt with insect pests and methods of dealing with them. Papers read during session:

"The Tent Caterpillar," Dr. Brodie.

"Some Recent Additions to the Society's Collection," Mr. Williams.

"Collecting at Niagara Glen," Mr. Hahn.

"Parasitism," Dr. Brodie.

"Insect Intelligence," Dr. Brodie.

"The Tussock Moth," Dr. Brodie (2 papers).

"A Temagami Trip," Mr. Hahn.

One evening during the session was devoted to specimens, and proved very interesting.

Donations to the Society's collection have been received during the past year from Mr. Hahn, Mr. Saunders, Mr. Fraser, and Mr. Williams. Some work has been done in arranging the Lepidoptera, and Mr. Fraser has undertaken to rearrange the Dragon-flies.

Publications have been received from Ottawa and Washington, from the Ohio and Connecticut Experiment Stations, and from New York State Museum, and a copy of "Butterflies of the West Coast" has been procured for our library.

The Treasurer reported a balance on hand of $6.95.

Respectfully submitted,

E. Blackmore, Secretary.

REPORT OF THE BRITISH COLUMBIA BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE YEAR 1906.

The fifth annual meeting of the above Branch was held at the Queen's School, Vancouver, on January 26th, 1906.

The following members were present: Messrs. A. H. Bush, R. V. Harvey, R. S. Sherman, W. A. Dashwood-Jones, B. Marrion, J. Towler, R. Draper, F. Foster.

On the motion of Mr. Dashwood-Jones, Mr. Bush took the chair, in the unavoidable absence of the President.

The minutes of the last meeting were read and confirmed.

The Treasurer presented his report, showing a balance in hand, in cash and supplies, of $15.50.

Messrs. J. R. Anderson and F. Foster (junior) were elected members of the Branch.

The retiring officers were re-elected for the coming year: President, Rev. G. W. Taylor; Vice-President, T. Wilson; Secretary-Treasurer, R. V. Harvey.

The Secretary announced that he had approached the Provincial Department of Agriculture with a view to obtaining assistance towards printing a small periodical giving an account of the work of the society. He read a letter from the Hon. R. G. Tatlow, definitely promising aid for one year.

A resolution was passed, accepting with thanks the offer of the Department, and the President and Secretary were empowered to arrange for the publication of a periodical, to be called the "Bulletin of the B. C. Entomological Society."

Two numbers of this Bulletin have already appeared, and the third is on the point of appearing. These numbers contained: Proceedings of the Branch; A Summary of the work done in B. C. up to date; Lists of interesting captures; General articles, and lists of various families of insects as they have been recorded in British Columbia. These comprise: Coccinellidæ (33 species), Buprestidæ (19 species), Cicindelidæ (15 species); in Diptera, the Tabanidæ (18 species), Bombyliidæ (23 species), Therevidæ (1 species), and a list of 28 species of Odonata. (Note by the Secretary.)

Mr. Dashwood-Jones then showed some interesting insects from St. Leon Hot Springs, Kootenay Lake, B.C., determined by Dr. J. Fletcher, including: Basilarchia arthemis, Basilarchia disippus, Nomiades lygdamus, Erebus odora, Catocala briseis, Phengommatæa Edwardsata and Sthenopis quadriguttatus.

Dr. Draper showed a fine series of Lepisesia flavofasciata, var. ulalume.

The meeting then adjourned.

The spring meeting was held at Duncan's, on Vancouver Island, on April 19th.

The following members were present: Rev. G. W. Taylor (President), Messrs. A. W. Hanham, C. Livingston, E. M. Skinner, G. O. Day, T. M. English and R. V. Harvey.

The minutes of the last meeting were read and confirmed.

Messrs. F. Wolley-Dod, G. O. Day, and T. M. English were elected members of the Branch.

Mr. Harvey read a paper on the "Distribution of Insects in North America," calling attention to the far greater similarity between our fauna and that of Europe, than between the latter and that of eastern North America.

Messrs. Livingston and Skinner showed some rare Lepidoptera, the latter having a fine specimen of Sthenopis quadriguttatus, from the Skeena River.

The meeting then adjourned.

REPORT OF THE GUELPH BRANCH.

On the occasion of the forty-second annual meeting of the Ontario Entomological Society, held at the Ontario Agricultural College, Guelph, on October 18th and 19th, 1905, action was taken which resulted in the formation of a Guelph Branch of the Society.

This new Branch was organized with the following officers:

President—Franklin Sherman.

Vice-President—Richard Readwin.

Secretary-Treasurer—T. D. Jarvis.

Committee—Messrs. Sherman, Jarvis and C. R. Klinck.

An encouraging membership of 27 was secured, and the wisdom of the step was shown. The beginning augured well for live and enthusiastic work, and the most sanguine hopes have been fully realized.

During the year sixteen meetings have been held at fortnightly periods, alternating with those of the Wellington Field Naturalists' Club. The attendance averaged thirty and included visitors from the Nature Study classes of Macdonald Institute, and teachers and others from the city of Guelph.

At each meeting talks and papers were presented, which were occasionally illustrated with lantern views. Their nature will be indicated by the following classification which appears on the printed invitations sent out:

General Entomology.

Entomological Literature.

Economic Entomology.

Observations and Notes by Members.

At the conclusion of this one year's work the Branch was merged with the parent society whose headquarters are now at this place.

Tennyson D. Jarvis,
Secretary-Treasurer.

REPORT TO THE ROYAL SOCIETY OF CANADA.

From the Entomological Society of Ontario, through Mr. A. F. Winn, Delegate.

As Delegate from the Entomological Society of Ontario, it is my pleasing duty to report another year of steady progress, and that our membership is increasing very rapidly. At your last meeting the establishment of a branch in British Columbia was mentioned, and since then another had been formed in Guelph, Ont., where there are a number of active and enthusiastic entomologists.

The parent society in London, with its branches at Quebec, Montreal, Toronto, Guelph and Vancouver, and active members in every Province of the Dominion, is able to accomplish much that would be impossible if the sphere of work were limited to a more restricted area.

The last volume, No. 38, of our monthly magazine, *The Canadian Entomologist*, contains 426 pages—a contrast with the first modest one of 110 pages—and is illustrated with twenty-nine figures in the text from original drawings, and seven full page plates, one of the latter being a three-color process plate of moths, showing the beauty as well as scientific accuracy of this style of illustration. Among the sixty-two contributors to its pages, some are from such distant places as Jamaica, W.I.: Honolulu, and the Philippine

Islands. Eleven new genera of insects are described, and one hundred and forty-two new species. Articles on new species and varieties of Lepidoptera, by Dr. J. B. Smith, Dr. Wm. Barnes, Dr. H. G. Dyar, Prof. Fernald, Miss Murtfeldt, Messrs. H. H. Lyman, F. H. Wolley-Dod, A. Gibson, W. D. Kearfott.

Coleoptera, by Prof. H. F. Wickham, Major T. L. Casey, Messrs. Frederick Knab and Wm. Knaus; Orthoptera, by Messrs. E. M. Walker, and W. T. Davis; Hemiptera, by Messrs. J. R. de la Torre Bueno, E. D. Ball, D. Lange, and G. W. Kirkaldy; Hymenoptera, by Dr. W. H. Ashmead and J. H. Lovell; Diptera, by Mr. W. D. Coquillett, Miss C. S. Ludlow and Dr. Grabham. Life histories are given more or less completely of Eupithœcia interrupto fasciata, Apantesis virgo, parthenice and rectilinea, by Mr. A. Gibson; Apantesis proxima, by Dr. O. Siefert; Gortyna thalictri, by Mr. H. H. Hyman; Delphastus pusillus, by Mr. W. E. Britton.

A series of articles on Practical and Popular Entomology consists of the following:

"The Pear-tree Psylla and how to deal with it," by Mr. George E. Fisher; "Entomology in Schools," by Mr. H. S. Saunders; "How do Insects pass the Winter?" by Dr. James Fletcher; "Notes on Collecting Aquatic Hemiptera," by Mr. J. R. de la Torre Bueno; "Canadian Three-color Process Illustration," by Dr. James Fletcher; "The Struggle with the Codling Moth," by Prof. W. Lochhead; "Granary Insects,' by Mr. A. Gibson; "A Method for Measuring Insects," by Mr. J. R. de la Torre Bueno; "The Buffalo Carpet Beetle," by Dr. James Fletcher.

Articles on Classification include a catalogue of the Aphidæ, by Mr. G. W. Kirkaldy; "The Bees of Oregon," by H. L. Viereck and others; "The Three Ranatras of the Eastern United States," by Mr. J. R. de la Torre Bueno; "Mosquito Notes," by Miss C. S. Ludlow.

Among the miscellaneous papers may be mentioned: "Observations on Lampyridæ," by Mr. Frederick Knab; "Notes on Types in the British Museum," by Mr. H. H. Lyman; "Remarkable Flight of Corisa (Water-boatmen)," by Mr. D. Lange; "Spiders of Rockport Cave, Mo.," by Mr. C. R. Crosby; "Influence of the Apidæ upon Geographical Distribution of certain Floral Types," by Mr. J. A. Harris; "Oviposition of Bibio Femorata," by Mr. A. H. Girault.

Book notices have appeared promptly of new entomological works.

The forty-second annual meeting was held in October at the Ontario Agricultural College, Guelph, with an attendance at some of the meetings of over one hundred, and the Society was favored with the presence of Prof. John B. Smith, State Entomologist of New Jersey. Reports were presented on the injurious and other insects of the various districts in Ontario, from the different Branches and Sections of the Society, and addresses and papers were given on a variety of subjects. The thirty-sixth Annual Report of the Society to the Ontario Government has been published, comprising one hundred and forty-four pages, and, as usual, contains a full account of the work of the previous year, and the papers read at the annual meeting, as well as numerous articles of an economic nature, giving to fruit-growers and agriculturists an account of injurious insects along with the best methods of attacking them.

Among these may be mentioned: "A Review of the Mosquito Work in New Jersey," by Dr. J. B. Smith; "Experiments Against the San José Scale," by Prof. Lochhead; "Entomological Conditions in North Carolina," by Prof. F. Sherman; "Reports on Insects of the Season 1905," by Prof. Lochhead, Dr. Fletcher, Dr. Fyles, Dr. Bethune, and Mr. C. Stevenson;

"The Tussock Moths," by Dr. Fyles and Mr. H. H. Lyman; "The Phlox Mite; the Blue Spruce Fly, and, On Bumble Bees that Fertilize the Red Clover," by Mr. T. D. Jarvis; "Forest Insects," by Rev. Dr. Fyles and Mr. E. J. Zavitz; "The Advantages and Disadvantages of the Canadian Entomologist," by Rev. Dr. Fyles; "Butterfly Collecting in Canada," by Mrs. Nicholl; "Orthoptera and Odonata from Algonquin Park," by Dr. E. M. Walker; "Insects as Nature Studies," by Prof. S. B. McCready; "Injurious Insects of the Flower Garden," by Mr. Arthur Gibson.

The library now consists of over eighteen hundred volumes, and a card catalogue according to subjects has been begun. The collections at London are open to the public three days a week, and advantage is taken of this opportunity, the number of visitors being increasing.

The branches are all in a satisfactory state, and our friends in British Columbia have decided to issue a quarterly "Bulletin," the first number of which has just appeared, and contains much information on the insects of British Columbia, particularly on the Coleoptera. It was felt that, as the members in that Province are so widely scattered, a medium of communication would bind them together, and we should like to see the members in the Maritime Provinces and also in the North-West follow a similar course, so that our Society could have a chain of branches from the Atlantic to the Pacific.

REPORT OF THE LIBRARIAN AND CURATOR.

During the year ending August 31st, 1906, thirty-eight bound volumes have been added to the Library, making the total number on the register 1900, also a large number of periodicals and pamphlets. Among the new books may be mentioned the Autobiography of the late Miss Eleanor Ormerod, LL.D.; Mr. A. G. Weeks's Illustrations of South American Diurnal Lepidoptera; the second part of Prof. Packard's Monograph of the Bombycine Moths; Mr. W. G. Wright's Butterflies of the West Coast of the United States; and Prof. Needham's May-flies and Midges of New York. During the year 38 volumes were issued to local members.

Owing to his appointment to the Professorship of Entomology at the Ontario Agricultural College, which took place on the 1st of June, the Librarian and Curator was absent from London during the last quarter of the Society's year. There are, therefore, few acquisitions to the collections to be recorded for this season, and the attendance of visitors during the summer months was almost entirely precluded. The following contributions have been made to the collections since our last report, and our grateful thanks are due to the kind contributors: 35 specimens of Lepidoptera, Coleoptera and Hymenoptera, by Dr. James Fletcher, Ottawa; 23 specimens of Lepidoptera by Mr. H. S. Saunders, Toronto; 118 specimens, representing 63 species of Manitoba Coleoptera, by Mr. Norman Criddle, Aweme, Man.; 22 specimens of Coleoptera, by Dr. A. H. R. Watson, Port Hope; 6 specimens of Coleoptera, by Mr. A. C. Baker, London, and a number of interesting specimens of various orders by Mr. J. A. Balkwill, London.

The removal of the Society's books and cabinets and other property from London to Guelph has been safely accomplished without any appreciable injury to the specimens, and all are now placed in their new quarters in the Massey Hall Library and the Biological Building at the Ontario Agricultural College.

Respectfully submitted,

CHARLES J. S. BETHUNE,
Librarian and Curator.

AUDITORS' REPORT.

For Year Ending August 31st 1906.

Receipts.

Bal. on hand Sept. 1st, 1905	$517 76
Members' fees	399 67
Sales of pins, cork, etc.	41 38
Sales of Entomologist	190 50
Advertisements	46 91
Interest	7 20
Government Grant	1,000 00
	$2,203 42

Disbursements.

Pins, cork, etc.	$ 26 95
Printing account	863 19
Rent	140 00
Insurance	24 00
Expense account, postage, moving, etc.	204 37
Annual Meeting and Report	172 81
Library	12 35
Salaries	237 50
Balance	522 25
	$2,203 42

A HUNT FOR A BORER.

By H. H. Lyman, M.A., Montreal, Que.

On pages 154-156 of Vol. VIII of the *Canadian Entomologist*, published in August, 1876, appeared a paper, ostensibly by Dr. Leon F. Harvey of Buffalo, describing four species of new Noctuidæ, one being *Gortyna Appassionata.* The single type specimen had been received from Mr. E. B. Reed of London, Ont. I believe it was later claimed by Grote that he wrote Harvey's descriptions, and the type specimen was doubtless sent for name to Grote, and remained in the Grote collection and passed with it to the British Museum. On the rediscovery of the species, Grote disclaimed responsibility for the name, which he said was not Latin but Italian. Although there were a very few unrecognized specimens of this species in American collections, such as the collection of the American Entomological Society of Philadelphia, the species remained unknown save for its name in the catalogues and the one type specimen in the British Museum, though certain strongly marked specimens of *Marginidens* were identified with it by a prominent entomologist, who had seen the type on a visit to London. The description was accurate enough with certain exceptions which I, at least, fail to understand. The ground color of thorax and wings was stated to be "of a dark red color, the terminal space glistening red, subterminal space wide, concolorous purple." The last clause I consider misleading, as in many specimens the space from the t.p. line to the margin is of a uniform deep brownish red color, with only the faintest indication of the subterminal line, but I confess that in one of my specimens the space between the t.p. and s.t. lines has a purplish tinge which renders it darker than the space beyond, but the statement which I consider most incomprehensible is that "it is allied to *Nitela*, differs from it by the wider, rounder reniform, the three larger superposed spots on the t.a. line, the wider concolorous subterminal space and the more regular lunulate t.p. line."

In 1901 or 1902, Mr. Louis H. Joutel, as Mr. Bird has so interestingly told in Can. Ent. XXXV., 91-94, discovered an unknown larva of the genus, Gortyna, Hydrœcia, Papaipema, or what you will, feeding in the roots of the Pitcher Plant (*Sarracenia Purpurea*) in the pine barrens near Lakewood, N. J., and Mr. Bird, having secured a supply of larvæ and food plant, was able to carry to maturity a goodly number of specimens, many of which, with his usual generosity, he distributed to important collections.

Fired with the ambition to secure this beautiful and rare species, I determined to take an early opportunity of seeking it in the locality whence came the type and so prolonged a business trip to Toronto into an entomological expedition to the then headquarters of our Society.

I left Toronto by the International Limited on the afternoon of July 9th, 1903, reaching London the same evening. After supper I called upon Mr. Dearness, who very kindly advised me as to the best remaining locality in which to look for the food plant, and promised to see Mr. Balkwill in the morning as to the most likely guide to the happy hunting ground. The next morning Mr. Balkwill called for me at the hotel and after some delay we succeeded in chartering a vehicle from a livery stable with a boy to go with us. We drove some distance into the country to a likely swamp, and then, leaving the vehicle in charge of the boy, Mr. Balkwill led the way to where the Pitcher Plants grew. There were no great masses of them, and probably they do not grow that way, but they were scattered about here and there through the swamp. I searched many but found no larvæ nor even any trace of them. Once I thought I had found one, as there was frass among the leaves near the root, but I found it had evidently dropped from some larva on the tree above, and the plant was without any borer. Now, I could never be mistaken about the frass of this species as it is reddish in color. After spending over an hour in the hunt without success, I abandoned the search and went with Mr. Balkwill to where cocoons of Samia Columbia had been found on larch in another part of the swamp, but saw none. We then returned to the city.

The next year I made a trip to Italy and so had no opportunity of looking for this species, but last year I determined to make another attempt, and as I also wanted to make a hunt at Kittery for *G. Harrisii*, I planned a four days' trip to Prout's Neck, Me., to search for these species, have a few dips in the sea, and a little golf. I left home on the evening of the 22nd July, and arrived at my destination before 11 a.m. the following morning, and in the afternoon set out accoutred for the chase. It is a good walk from Prout's Neck to the locality I was in search of, which I had not visited for nearly twenty years, and when I found the place my heart sank, as the area where the Sarracenia grew was so restricted, not occupying more than about a fifth of an acre between a wood which shut it off from the road and a salt marsh. However, I set to work, and as the result of about two hours' work secured three nearly mature larvæ. I then set out on a brisk walk to the hotel, happy at my success.

The next day was bad, as it rained all day, but towards five o'clock the rain stopped and the sun came out, and I sallied forth for a walk, though it was too late to go to the Pitcher Plants. After going for some distance along the road, I came to where some evening primroses grew and started a hunt for that lovely moth which used to be called *Alaria Florida*, but for the present is known as *Rhodophora Florida*, and secured quite a number of them asleep in the blossoms. I then turned off from the road across a stretch of meadow land to a drainage ditch along which the Poison Hemlock (*Cicuta Maculata*) grew abundantly, and in a very short time I had secured over a dozen practically mature larvæ of *G. Marginidens*, which Dr. Holland calls a rather scarce species, and only left off grubbing them up because I had filled up all my tin accommodation with the roots and enclosed larvæ, and I believe I could have easily gathered fifty.

The next morning I again visited the Pitcher Plants and devoted nearly two hours more to the search, and having secured two more larvæ and a newly formed pupa, which I took to be of this species and which was dis-

closed on pulling up a Pitcher Plant, I contented myself, as I did not want to clear the locality, and so kill the goose that lays the golden eggs.

This species will, I think, always be rare in collections as the difficulties in the way of securing any large number are so great. It requires most patient search to find them, and the root of the plant is so small that it takes two plants, at least, if not more, to nourish a single larva. They appear to enter the root from the crown among the bases of the petioles of the pitchers, and when all the edible part of one root is consumed they go to another, and I found several bored roots which had been abandoned. The beautiful crimson of the moth is evidently derived from the food-plant, as even the frass is red.

The plants in the locality visited by me grow among a very spongy moss and the larvæ when full fed appear to leave the roots before pupating, and in my breeding jars they pupated in the moss. Having provided myself with a sufficient supply of the roots to bring the five larvæ to maturity, I felt that that portion of my expedition had been successfully accomplished, and in the afternoon played a couple of rounds over the course of the Owascoag Golf Club with a good conscience.

The next morning I took the train for Kittery Junction, and from there the next train to Kittery Point, a very short distance, and then set out to walk. Morning and afternoon I must have tramped fifteen miles, but did not find a single plant of *Heracleum Lanatum*, the food-plant of *G. Harrisii*, and I found little except a further supply of *Rhodophora Florida* in the flowers of Œnothera. In the late afternoon I returned to Portland, and left for home by the night train, which I reached on the morning of the 27th.

The five larvæ duly pupated and were taken with me on the eclipse expedition to Labrador. Just before leaving, the pupa which I had found disclosed the imago and proved not to be a Gortyna at all. Of the five pupæ reared, one died, one moth was unable to emerge. I performed a delicate surgical operation and removed the pupa case, but the wings would not expand. One emerged and apparently hid among the moss and so escaped notice and damaged itself, so only two perfect specimens were secured.

Postscript.—Mr. C. H. Young of Hurdman's Bridge, near Ottawa, who has been very successful in rearing *G. Appassionata* during the season of 1906, has favored me with the following notes through Dr. Fletcher:—

On July 12th, he found the larvæ in large numbers in a very wet swamp at the upper end of Meach Lake, Que., about fifteen miles north of Ottawa, at which time they were about half grown, but were full grown by the 25th. He noticed particularly that they were found only in the large plants and where the plants grew very thickly. According to Mr. Young's observations, the larvæ leave the root of the Pitcher Plant when mature, and pupate among the old decaying pitchers that are at least two years old and lie out among the moss. A very large proportion of the larvæ found by Mr. Young were attacked by a fungoid disease or by insect parasites of two species, one hymenopterous and the other dipterous.

TWO INSECTS AFFECTING RED CLOVER SEED PRODUCTION.

By Tennyson D. Jarvis, Ontario Agricultural College, Guelph.

The question of clover seed production is one of extreme interest to all who have the prosperity of agriculture at heart. While the seed cannot be considered as a staple money crop in most sections, the use of the plant

has become so extensive and well-nigh universal, that the supply of the seed is becoming more and more a matter of paramount importance. The increased use of clover is indicated by the decided advance which has already taken place in the market price of the seed; and from this circumstance it is less than ever before keeping pace with the demand for it. It would seem the natural conclusion that interest should be stimulated in the production of such a remunerative commodity, and the fact that it has not been to a sufficient extent to control the price, suggests that there may be some offsetting factors to be taken into account—which is indeed the case. A reference to the annual reports of the Bureau of Industries of Ontario, reveals almost invariably a more or less unsatisfactory yield of clover seed. Furthermore, in examining carefully a large number of heads of clover here this fall, it was found that only 42 per cent. of the florets had produced seed, and undoubtedly the percentage is frequently much lower than it is this fall. It is not unusual for the yields to be so low as to render the harvesting unprofitable. In fact so uncertain and precarious a crop is it, that on a commercial scale it is a regular crop in only comparatively limited sections of Ontario, and in the other Provinces of the Dominion is but little grown. This general uncertainty of obtaining a reasonably full yield of seed is due to various causes. The plants on heavy or undrained land may be weakened by winter heaving; or on light soils their growth may be checked by summer droughts. The soil in some sections is so deficient in its retentiveness of moisture, that it is only in exceptional years that any considerable aftermath is produced. Insect ravages, and imperfect fertilization are two other causes. In the present article we propose to deal only with the two latter factors, showing how the presence of certain insects, and the absence of certain others, combine to affect adversely the yields of clover seed.

There are fully a dozen insects which do appreciable injury to some part or other of the red clover plant, but by far the most destructive to the seed is the Clover Seed Midge (*Cecidomyia leguminicola*). This insect has gained a wide range in America, and every year causes an immense depreciation in the yield of seed. It is estimated that the loss in Ontario ranges in various localities, all the way from 25 to 75 per cent. In an examination of 50 heads of clover late in September, when in all probability some of the midges had already escaped, 164 of their larvæ were found.

The insect which is responsible for this destruction is a minute two-winged fly, which appears in May or early June, and lays its eggs on the developing heads of clover among the bristles which surround the young florets. From these eggs, which are so small as to be almost invisible to the naked eye, the larvæ hatch and find their way down the opening corolla tubes to the future seed at the base. Small as they are they may be readily seen if placed on a white surface, and appear variable in color from whitish to orange-red. They feed on the doughy seeds until fully-grown, about the last week in June, when they emerge from the florets, and dropping to the ground transform to the pupal stage just below the surface. The pupæ develop to the adult fly in time that these may lay their eggs upon the second growth of the clover for another brood of the maggots. Thus both crops of clover are attacked, and after the damage is done the midges remain to go into hibernation until another year's supply of food is ready.

In order to combat this pest, it is only necessary to bear in mind the date at which the first brood is likely to pupate; and by cutting the crop a little in advance of this time destroy the whole brood, or by pasturing until danger from the first brood is past, prevent altogether the deposition of the

eggs on the crop. In accordance with this, it is now recommended to pasture closely until the month of June, when the clover may be allowed to grow for a late crop of seed; or if the crop has been left for hay, to cut this not later than June 20th, and obtain the seed from a second crop. Where these rules are observed, the injuries of the midge can be largely avoided. However, so long as some growers persist in disregarding them, it will find ample means of propagation; and so long the rest must expect to be obliged to maintain their precautions.

Having seen how the presence of one insect is so inimical to success in clover seed production, we will notice next how the presence of another is essential to the same.

Red clover, particularly the first crop, often fails to produce seed freely owing to imperfect fertilization. To understand this we need to notice two facts: 1. This plant is incapable of self-fertilization, and is therefore dependent on outside agencies for the performance of this office; and 2. The flower is so constructed, that very few of the agencies which operate in the cross-pollination of other flowers can take part in this case.

1. Inability to self-fertilize.

Many plants are known which, owing either to the structure of their flowers, or the ineffectiveness of the pollen on the pistils of the flower from which it is derived, do not self-fertilize. The red clover is an example as we shall notice presently. The flowers or florets of which the head is composed, have the four sets of organs which we find in other complete flowers. The corolla is a long tube having its lobes curiously fashioned so as nearly to close the opening or mouth. Within and enclosed in the lower lobes called the keel, are the pistil and surrounding it the monadelphous stamens. Notice particularly that the stigma of the pistil reaches up beyond the anthers of the stamens. Owing to this peculiarity, the pollen in falling does not usually come in contact with the stigma, and the plant evidently requires the intervention of insects for its pollination. That this is the case has been repeatedly proved by the exclusion of insects from the clover plants, with the result that under such circumstances no seed was produced.

2. Limited number of agencies which can pollinate red clover. Since insects do so much in carrying pollen between other plants, let us see why they are not equally useful here. We notice by examining a floret, that in order that pollen from another flower may come in contact with its stigma, it must be borne by some insect which in lighting on the keel, is heavy enough to pull it down so as to release the essential organs (pistil and stamens) from it; and then in probing with its proboscis for the nectar at the base of the corolla, will brush on to the stigma any pollen which may have become attached to it in visiting other flowers previously. The nectar, or sometimes the pollen which it bears, is the incentive which brings insects to a flower; but in the case of the red clover, the neck of the corolla tube is so long, that of the insects heavy enough to open the flower, only a very few have mouth parts long enough to reach the bottom. Bumble bees (*Bombus*) of various species, are practically the only insects which so habitually visit the flowers of red and mammoth clovers, as to be entitled to notice as a factor in their pollination. It is claimed that wasps often visit the flowers for honey, but instead of entering at the mouth in the orthodox manner, they cut a hole in the side within reach of the honey. Bumble bees have also been charged with this to some extent, and honey-bees will follow and utilize the holes thus made, but do not enter the flower; and so do not effect pollination. However, there is no doubt that bumble bees ordinarily visit the flower in such a way as to bring pollen to the stigma.

The honey bee seeking pollen and some other insects may occasionally be factors in this work, but cannot be considered as of any importance in comparison with the bumble bee. That these statements are based on fact may be strikingly seen in the experience of the New Zealand growers of clover seed. In that country attempts to obtain home-grown seed were scantily rewarded until, about 1885, the British Government introduced several species of bumble bees. These insects reproduced rapidly, and have effected a vast improvement in the yields of seed obtained. So manifestly beneficial did they prove, that the New Zealanders are now looking about for still further species which they might with advantage import. In the summer of 1905 a letter was received by the Ontario Department of Agriculture from the Canterbury Agricultural and Pastoral Association of New Zealand, seeking information as to what species of insects perform the service of pollination in this country, in the hope that some superior to what they have might be secured.

There are in America as many as fifty or sixty distinct and described species of bumble bees. Only a few of these, however, are sufficiently plentiful to be of economic importance. In an excursion through a clover field at Guelph this fall, three species were collected, namely, *Bombus fervidas, B. ternarius, and B. borealis*; the first of which was by far the most common. About Toronto another species, *B. consimilis,* is reported by Dr. Brodie as one of the most numerous.

Since the bumble bee plays such an essential role in connection with the production of clover seed, it will be worth our while to enquire into its life history and habits, for thereby we shall be enabled to arrive at some important practical conclusions.

Bumble bees, like the honey bees of domestication, have among them three kinds of individuals; the queens or females, the males, and the workers or undeveloped females. All these will be found in a colony in the fall; but on the approach of winter, the males and workers all perish, and the fertilized queens alone go into hibernation, to perpetuate the species another year. They remain in sheltered places, and in the spring those which have survived, set out separately to found each a colony of its own. The first care is to find a suitable place for the nest which is to be the home. They often appropriate deserted nests of field mice, and also construct nests for themselves of dried grass, or moss, or of wool, locating them in a depression in the ground. In this is stored a mass composed of wax, pollen and honey, in the latter part of which a number of eggs are at once deposited. Other cells similar to the first are added from time to time, and more eggs deposited as fast as their accommodation can be provided for. Owing to this method of procedure, the resulting comb receives the characteristically aimless construction with which we are so familiar.

As the young larvæ hatch, they feed upon the mass of pollen and honey in which they lie. When fully grown, each spins a lining to the cell which it has formed, and transforms to the pupal stage, finally emerging by gnawing its way out as a perfect bumble bee. After being thus emptied, these cells are not used again for the same purpose, but become the receptacles for the honey which is collected by the new brood of bees. For some time only workers are produced, and as they become numerous enough the queen is relieved from the various duties of collecting material, building comb, and so forth, all of which she has performed until now, and devotes her energies exclusively to the laying of eggs. Thus by the end of summer a populous colony may have been built up from the slender beginning of the spring. About this time, young queens and males also are produced, and

so when cold weather breaks up the colony, a number of queens are left to multiply colonies the following year.

This gradual increase from individuals to colonies of bees accounts for the greater yields of seed usually secured from a crop of clover late in the season. The flowers of the first crop opening in the latter part of June are not, as is sometimes supposed, any less capable of setting seed; but since they must be fertilized in order to produce seed, it follows that the yield will be in some proportion to the numbers of the bumble bees, and consequently greatest in the fall.

The practical applications which we may now make of the information we have about these two insects, the clover seed midges and the bumble bee, can be presented as follows. The life histories of both alike demand that a late crop of clover be used for seed; and therefore it is the utmost folly to strive to produce it at the time when Nature's odds are most strongly against us. The abundance of bumble bees, which is so much to be desired, may be materially augmented by a policy on our part of "letting live." An instinctive impulse which seems to be inherent in man, and persists long fter he has lost the overflowing animal spirits of youth, makes the lot of the bumble bee a precarious one. In so far as we can, then, let us inspire youth with a considerate regard for the rights of the weak creatures, which are so often our friends; so that these thoughtless raids may appear to them despicable as they truly are, and if we ever find that the chance discovery of a bumble bees' nest stirs up in us some latent spirit of adventure, let us firmly suppress it as befitting a worthier occasion.

INJURIOUS INSECTS OF 1906 IN ONTARIO.

By C. J. S. Bethune, Ontario Agricultural College, Guelph.

Owing to my removal from London to Guelph in the early part of June, and subsequently the transfer of the property of the Entomological Society to its new quarters, my opportunities for outdoor observations have been somewhat limited during the past summer. I have, however, received a large number of enquiries, generally accompanied with specimens, from various parts of Ontario, and frequently visitors to the College have brought injurious and other insects for identification and information. In this way I have been enabled to learn something about the most troublesome insects of the season and their distribution throughout the Province. The extensive gardens, field-crops and plantations on the College premises have also afforded convenient places for the detection of injurious species. There has been no one great outbreak to mark the year, but many forms have been more abundant than usual and nearly all the common pests have been as destructive as ever.

Garden Insects.

The White Fly (*Aleyrodes vaporariorum*, probably) also called the Mealy-winged Fly, has been very abundant this year. My attention was first drawn to it by its occurrence in large numbers on greenhouse plants, such as fuchsias, roses, etc. In the early part of July, in order to make alterations in the greenhouses, all the plants were brought out-of-doors and remained there during the rest of the summer. Owing to this, in all probability the White Flies were subsequently found on a large number of

plants in the vegetable garden, viz., beans, beets, carrots, cucumbers, parsnips, radish, rhubarb, salsify, squash, summer savory, tobacco, tomatoes; and on sunflowers and hollyhocks and a number of perennials in the flower garden. It, or probably another species, was also abundant on wild ginger. The waxen scale-like cases, under which the larvæ live, were to be found in

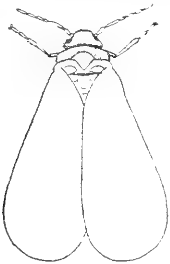


Fig. 3.—Mealy White Fly. Greatly enlarged. (After Gossard).

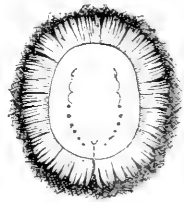


Fig. 4.—Scale-like covering of the larva. Greatly magnified. (After Gossard).

large numbers on the leaves and stems of the affected plants. In many instances considerable damage was done, not only by the loss of sap drawn off by these sucking insects, but also by the growth of fungus on the "honeydew" that is secreted by the larvæ on the foliage beneath them. The only remedy for them appeared to be spraying with kerosene emulsion. Where a greenhouse is infested fumigation with hydrocyanic acid gas should be resorted to. The accompanying figures (figs. 3 and 4) represent the characteristic forms of the fly and the scale-like covering of the larva; both are very greatly enlarged.

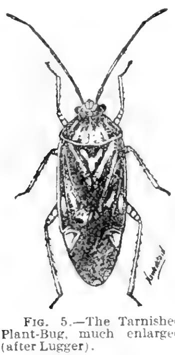


Fig. 5.—The Tarnished Plant-Bug, much enlarged (after Lugger).

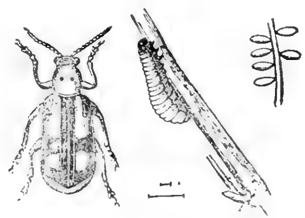


Fig. 6.—The Blue Asparagus Beetle; eggs and larva—magnified.

The Tarnished Plant-bug (*Lygus pratensis*) was another very abundant insect this year. It was first noticed in large numbers on the chrysanthemums that had been brought out of doors from the greenhouses; it attacked their terminal shoots and thus injured and in some cases destroyed the buds and future flowers. It was also to be found on asters and a number of other flowering plants in the borders, and on asparagus, beets, carrots, celery,

parsnips, potatoes, salsify, etc., in the vegetable garden. Early in the season it did some damage to strawberry and currant blossoms. This is a true bug and, like all the other members of the order, obtains its food by piercing the tissues of the plant it attacks and sucking out the juices. The adult insects (fig. 5) are about a quarter of an inch in length and vary in colour from yellowish-green to a dark brown. It may easily be recognized by the yellowish lines on the thorax and the yellow V-shaped mark just behind them on the scutellum. Choice plants may be protected by dusting with Pyrethrum insect powder mixed with three or four times its weight of flour and applied in early morning when the insects are sluggish and the foliage is moist with dew. On a larger scale kerosene emulsion or a decoction of tobacco may be used with advantage, if applied early in the morning before the bugs become too lively.

The two species of Asparagus Beetles, the Blue (*Crioceris asparagi*) and the 12-spotted (*C. 12-punctatus*) were very abundant all through the season, and were to be found on the plants as late as the end of September. Until last year the latter species alone was to be found, but now the Blue beetle (fig. 6) has caught up to it here on its spreading movement northward and westward. Both species have no doubt come to stay, and it is a pest that will have to be reckoned with by asparagus growers from now onward, just as we have the Colorado potato-beetle always with us. In spring when the shoots are being cut for table use, the beetles may be kept off by dusting with lime; later on, when the plants have grown large, the larvæ of the Blue species will be found feeding upon the foliage and may then be destroyed by dusting with a mixture of Paris Green and lime, or with flour instead of lime, which is often difficult to procure. These larvæ are somewhat slug-like in shape and are of a greenish colour. The larvæ of the other species, the 12-spotted, feed upon the seeds of the asparagus plant and live inside the round pods. They cannot, therefore, be treated with poisons, but may be got rid of by cutting down and burning all the seed-bearing plants as soon as the pods have attained their full size and are beginning to turn red.

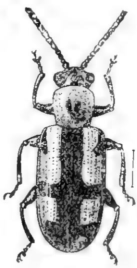


Fig. 7.—The Blue Asparagus Beetle. Enlarged 8 times. (After Chittenden, U. S. Dept. Agric.)

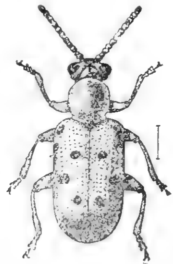


Fig. 8.—The 12-Spotted Asparagus Beetle. Enlarged 8 times). After Chittenden, U.S. Dept. Agric.)

Both beetles are often to be found on the same plant and may easily be recognized, one (fig. 8) being of a reddish-orange colour with 12 round black spots on the wing covers; the other (fig. 7) is of a shining blue-black colour with white blotches on the wing-covers. These vary a good deal in size and shape and sometimes form a cross of the ground colour on the back. They pass the winter in the adult state and are ready to attack the asparagus shoots

as soon as they appear above ground in the spring. Like many other hibernating insects, they take shelter under rubbish, and thus afford another argument for clearing up and burning all garden refuse in the autumn.

The Parsnip Borer (*Depressaria heracliana*, De Geer) is an old enemy, though not a very common one, of the second years' growth of parsnips, both cultivated and wild. This year it proved injurious to some plants in the College garden. The full-grown caterpillar is about three-quarters of an inch in length, of a dirty green colour above and yellowish on the sides and beneath, with a number of shining black warts on nearly all the segments. The young larvæ first attack the large umbels of flowers, covering them with a web, which is rendered very unsightly with masses of excrement. When the flowers have been all devoured, they burrow into the hollow stems, usually entering at the axils of the leaves and there feed upon the soft, white lining. If, however, there should be young parsnip plants near by, some of the larvæ are apt to attack them and eat up the tender foliage. By the middle of July they begin to turn into the chrysalis state and the small moths appear in August after a fortnight spent as pupæ. This year the first moths in captivity came out on August 15th, but we have sometimes had them as early as the 1st of the month. The moths are dull gray, varied with black scales and blotches, and have a flattened abdomen with projecting scales at the sides. They have a habit, like some others of the genus, of coming into houses and secreting themselves behind curtains and in garments, and are consequently mistaken for clothes moths. A full description of the insect in all its stages is given in the *Canadian Entomologist*, vol II., pp. 1-4, 1870. The only remedy for the attack seems to be the cutting off and burning all the infested flowers and stems.

Among the familiar insects against which the gardener has to contend every year, may be mentioned the Zebra Caterpillar (*Mamestra picta*), which was found devouring the foliage of beets, in addition to its usual attacks upon cabbage, turnips and other plants.

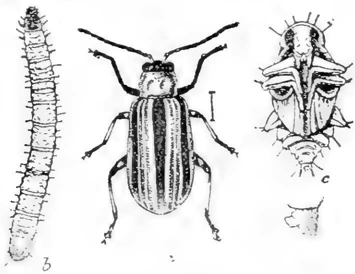


FIG. 9.—The Striped Cucumber Beetle: *a* beetle, *b* larva, *c* pupa. Enlarged 8 times. (After Chittenden, U. S. Dept. Agric.)

FIG. 10.—The Spotted Cucumber Beetle.

The Striped Cucumber-beetle (*Diabrotica vittata*)—fig. 9—and the spotted species (*D. 12-punctata*)—fig. 10—were both abundant during the later part of the summer in the blossoms of pumpkins and squashes; this was the second brood, the adults of which pass the winter as beetles, and are ready to attack young plants of the cucurbitaceous family as soon as they appear above ground in the spring. The second brood, though numerous, does no appreciable damage in the summer and autumn, as the plants are then so large and vigorous that the attack is unnoticed.

The root and stalk borers (*Gortyna nitela*—fig. 11—and *cataphracta*) were much complained of this year. The former was found in potato stems, and the latter was reported by Mr. C. W. Nash, of Toronto, as attacking all kinds of perennial plants in gardens, and also corn and tomatoes. It is difficult to prescribe any remedy for these insects, as they work out of sight and their presence is not suspected till they have seriously injured the plant.

Attacks by various species of Plant-lice (*Aphis*) were complained of in different parts of the Province; on Brussells-sprouts, for instance, at Stratford; on turnips at Grenfel; on hops at Shelburne; on sweet-peas at Penetanguishene; on honeysuckle at Toronto, etc. The ordinary remedies of spraying with kerosene emulsion or whale-oil soap wash have usually proved effective.

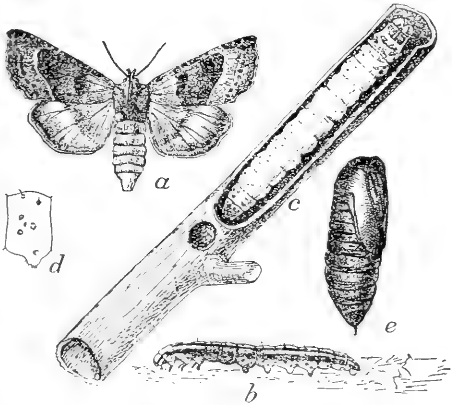


FIG. 11.—The Root and Stalk Borer (*Gortyna nitela*). *a*, female moth; *b*, half-grown larva; *c*, mature larva in injured stalk; *d*, lateral view of abdominal segment of same; *e*, pupa—all somewhat enlarged. (After Chittenden, U.S. Dept. Agriculture).

The Turnip Maggot (*Phorbia brassicæ*) was seriously injurious at Markdale, and the Onion Maggot (*Phorbia ceparum*) at Woodstock. For these underground insects there has not yet been found any perfectly effective remedy. In the case of the species attacking onions, it is recommended to dust the rows of plants with white hellebore once a week from the time that the young plants appear above ground; later on, when the bulbs are forming, the earth may be removed down to the roots and the exposed part dusted with white hellebore. The attack on turnips is not usually very severe, but the same species is liable to injure cabbages and radishes. It may be dealt with by spraying with a carbolic wash made of one quart of soft soap (or one pound of hard soap) in a gallon of water with half a pint of crude carbolic acid; this mixture should be boiled for a few minutes and when required for use, diluted with fifty parts of water to each one of the mixture. The application should be made once a week to the growing plants until the danger of attack is over.

Cut-worms and Wire-worms have given trouble in many places; at Mount Charles the Colorado Potato-beetle attacked and did considerable

damage to tomato plants. Cabbage-worms (*Pieris rapæ*) were very abundant this year, and were especially injurious to cabbages and Brussels sprouts, as well as to mignonette and nasturtiums in the flower garden.

White-grubs, the larvæ of May-beetles or "June-bugs" (*Lachnosterna*) —fig. 12—caused much damage to the roots of strawberry plants at Wallace, and were grievously complained of in consequence of their injury to lawns and golf-links at London, Woodstock, Paris, Watford, Durham, Coldstream and elsewhere. In the case of lawns and boulevards in cities and towns, where the affected area is not very large, spraying liberally with kerosene emulsion and washing it in with plenty of water, has been found somewhat effective. When the roots of the grass are so devoured that the turf will roll up like a carpet, which was the case in some places, it seems as if the only plan would be to remove a few inches of the soil beneath the sod containing the grubs, and then to replace with fresh earth and resod. In an enclosed garden poultry may be turned in to devour the grubs; robins and other birds render useful assistance also. Where the attack is on golf links, it would be found serviceable to enclose the infested spots with hurdles

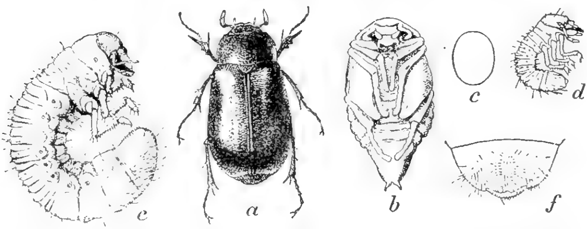


FIG. 12.—May Beetle: *a*, beetle; *b*, pupa; *c*, larva (White Grub)—slightly enlarged. (Chittenden, Bull. 19, n.s. Div. of Ent., U.S. Dept. of Agr.

and turn in a few pigs; these would soon root up and devour the grubs and could then be removed to another place. The parts of the field thus treated might then be levelled and resodded or sown with grass-seed. In ordinary cases the grubs thrive in old pastures, where they live underground for two or three years. A proper rotation of crops and the breaking up of all such fields is by far the most effective method of dealing with the insect. When the beetles are flying in May and June and doing much injury to the buds and foliage of trees and shrubs, spraying with Paris Green will kill large numbers; they can also be attracted by lights and destroyed. Boys also might be employed to gather them in early evening, and to search for them in their hiding places beneath the soil, along fences and against buildings.

FIG. 13.—Red-legged Locust.

While referring to pasture lands it may be mentioned that the Red-legged Locust (*Caloptenus femur-rubrum*)—fig. 13—was more than usually abundant this year throughout western Ontario and consumed a considerable amount of grass and cereals.

FRUIT-TREE INSECTS.

The Oyster-shell Scale, or Bark-louse as it is usually called, (*Lepidosaphes ulmi*) is now wide-spread on apple-trees all over Ontario and has become through neglect a serious injury. Twigs completely encrusted with the scales have been sent in from many places, our correspondents fearing that they had to deal with the dreaded San José scale. On the College trees the lime-sulphur wash has been found thoroughly effective. When properly made and carefully applied in early spring, before the buds begin to swell, it completely removed the scales and left the trees clean; at the same time it destroyed other insects which attack the buds. In previous reports full descriptions have been given of the methods of making the wash and the proportions of the ingredients, it is unnecessary therefore to repeat them here.

The Rose-chafer (fig. 14), or Rose-beetle (*Macrodactylus subspinosus*) has been remarkably abundant this year. Specimens have been sent or brought to me from Toronto on the east, to the County of Essex on the west, but none from localities east of Toronto. In the Niagara District and here

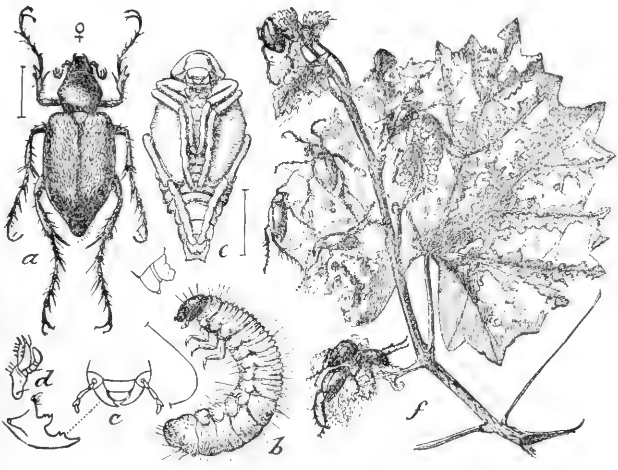


FIG. 14.—Rose Chafer (*Macrodactylus subspinosus*). *a*, beetle; *b*, larva; *c* and *d*, mouth-parts of same; *e*, pupa; injury to leaves and blossoms with beetles, natural size, at work. (After Marlatt, U.S. Dept. Agriculture.)

and there in the counties bordering on Lake Erie, the insect was especially abundant. In the neighborhood of London it has been prevalent for some years, but does not seem to extend much to the northward of the region referred to. There are, however, isolated occurrences in other parts of the Province recorded, as an example of which may be mentioned a severe attack upon young corn in the County of Grey last year.

The following is an account of the insect furnished by the writer to the *Toronto Globe* in July last, which may be repeated here:—

This destructive insect is called the Rose-beetle, from its attacks upon the buds and full-blown flowers of roses, which it burrows into and devours, but it by no means confines its attention to this plant. It is especially in-

jurious to the blossoms of the grape, upon which it clusters in great numbers and soon destroys all possibility of fruit, and it attacks the blossoms of fruit trees, large and small, ornamental shrubs, flowers, and in fact almost any kind of vegetable growth. It appears in immense numbers, and covers the plants that are attacked with a sprawling mass of beetles, full of alarm to the careful gardener and anxious grower.

The beetle is pale brown or drab in color, about a quarter of an inch in length, and with very long, spiny legs. The early stages of the insect are passed underground in sandy meadow land, where as a grub it feeds upon the roots of grasses and other plants. The eggs are laid by the female beetles in the ground during June and July, and the grubs become full-grown before winter; in the spring they turn into the pupa (or chrysalis) state, and come out as winged beetles in June. For about five weeks in June and July they abound, and then suddenly disappear, having completed their life course, not to be seen again till the following summer. Happily there is only one brood in the year.

It is a remarkable fact that the ordinary insecticides have little or no effect upon this pest, and it will eat blossoms sprayed with Paris green and thrive upon them. Many experiments have been tried, and it is found that, where the work is to be done on a large scale the congregated insects may be repelled by a wash made by adding about three pecks of freshly-slaked lime to a quart of crude carbolic acid in fifty gallons of water. This does not kill the insects, but the smell of the carbolic drives them away.

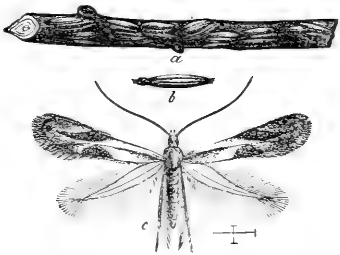


FIG. 15.—The Apple Bucculatrix. *a*, cocoons on twig; *b*, single cocoon; *c*, moth, greatly enlarged.

Another method is to spray the masses of beetles with half a pound of fish-oil soap in a gallon of water. It is claimed that this will kill about 95 per cent. of the insects. It acts by closing up their breathing apparatus and causing death by suffocation. On a small scale much may be done by beating the insects, in the early morning when they are sluggish, into pans containing a little coal oil and then burning them; or they may be knocked off into an open umbrella and then destroyed. Choice grapes or plants may be protected with netting.

It is now, however, almost too late to do much this season, as the destructive period of their lives is nearly over, but measures should be taken to prevent the recurrence of the pest next year. This can be done to a large extent by breaking up all the sandy meadows or old pastures in the neighborhood where the insects occur and putting in some crop instead. They do not breed in clay land, but in sandy soil, especially where it is damp from want of drainage. In this case, as in many others, the destructive insect has not much chance of appearing in injurious numbers if clean, scientific farming is carried out with a proper rotation of crops.

The large caterpillars of the Cecropia Emperor Moth were remarkably abundant this year on apple and crab trees at London, Brantford and Guelph. Being so large and voracious they consume the foliage very rapidly and soon strip a branch of its leaves. In Toronto Mr. Nash found it in considerable numbers on spiræa, as many as a dozen being seen on one bush in August. This handsome insect cannot be classed amongst our noxious species, as it rarely occurs in any numbers, being kept in check by its parasitic enemies; the cocoons in winter are also attacked by woodpeckers, who perforate the silken wrappings and suck out the liquid contents of the chrysalis.

Among other insects affecting the apple may be mentioned the Common Eye-spotted Bud-moth (*Tmetocera ocellana*) which we always have with us. The Apple Bucculatrix (*B. pomifoliella*)—fig. 15—mining the leaves, was

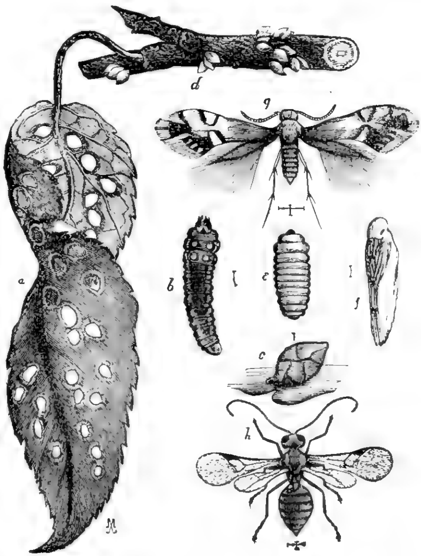


FIG. 16.—The Resplendent Shield-bearer. *a*, leaf showing holes made by insect; *b*, caterpillar; *c*, case; *d*, cases on twig; *f*, chrysalis; *g*, moth; *h*, parasitic fly.

abundant on some trees; its narrow, white cocoons were found in numbers on the twigs where the tiny caterpillars had attacked the foliage; at St. Catharines it occurred in injurious numbers.

An unusual attack upon the foliage of Quince trees was reported by Mr. Alister McKay, of Chatham. Large numbers of the leaves were found to be riddled with roundish holes in September, and in October the singular flat oval cases containing the chrysalids were to be seen in numbers attached to the leaves and to boards standing on end near the trees. The parent insect is a very beautiful minute moth called the Resplendent Shield-bearer (*Aspidisca splendoriferella*) which comes from the cocoons in May. The accompanying illustration (fig. 16) shows the insect in its various stages;

the moth is richly decorated with gold and silver streaks on its wings. The lime-sulphur treatment would no doubt clear the trees of these small cocoons and put an end to the attack.

Shade-tree Insects.

The Tussock Moth, which has been so often referred to and described in our Annual Reports, has continued its depredations on the shade trees of Toronto and some other places. It seems extraordinary that effective methods of control have not been adopted by those who have charge of the city parks and avenues. The remedy is simple, easy and effective and should not be very costly. It is only necessary to have the white egg-masses removed from the trees during the winter and destroyed by burning; this will get rid of the following season's crop of caterpillars. Trees once cleared, unless their boughs interlace wtih others that have not been attended to, will not be affected again for many years, as the female moths are wingless and they cannot travel any distance. Any cocoons that do not bear an egg-mass should not be interfered with as, if not empty, they contain either useful parasites or the chrysalids of the harmless males.

The Cottony Maple-scale (*Pulvinaria innumerabilis*) which has been excessively abundant on the shade trees in the streets of London for several years, and has also spread to vines and creepers, has at length begun to wane. During the past summer there was a very evident diminution in its numbers, so much so that it was hardly noticeable in some parts of the city and has ceased to excite alarm.

It is reasonable to expect, from past experience, that the insect will not be troublesome for some years to come, owing no doubt to the check it has received from useful parasites and unfavorable atmospheric conditions. At Guelph twigs were found this summer covered with the scales, but on examination it proved that not even one per cent. of them were alive; the rest were all dead and in many cases there was a hole in the scale through which the parasite had emerged. A similar condition was found in specimens sent from St. Mary's and Fergus.

The Black-banded Scale (*Eulecanium nigrofasciatum*, Perg.), called also the Terrapin Scale from its turtle-like shape, was found in great abundance on a maple tree near St. Catharines. Though not a common insect in Canada, it might easily become an injurious pest as it also attacks plum, peach, apple, linden, birch and several other trees. The affected tree was to be cut down and burnt in order to prevent any danger of the spread of the insect to the neighboring fruit orchards.

Another attack upon Maples of an interesting character was reported by Mr. Donald Fisher, of Vittoria, in September. The insect was the Maple-leaf Cutter (*Incurvaria acerifoliella*) which, in the caterpillar stage, cuts out round pieces of the leaves and forms with them a case in which it lives and hides. When in the case it feeds upon the leaf all round its dwelling and thus marks it with a series of blotches forming a circle on the surface of the leaf; when it has completed the circle in one place it moves to another on the same leaf and repeats the operation, till the leaf is covered more or less thickly with these round and conspicuous blotches. When the caterpillars are fully grown, the cases fall to the ground and the chrysalis stage is entered upon. There they remain all winter beneath the trees, and in the following May the tiny moths appear, pretty creatures with long, narrow pointed wings, the front pair steel-blue and the hinder ones smoky brown with a purplish reflection; on top of the head there is a tuft of bright orange hairs. These insects are sometimes numerous enough to completely defoliate

the maple trees they attack; but they are rarely to be found in numbers two years running, and as they work late in summer they do not injure the trees very much, the leaves having by that time nearly completed the discharge of their functions. If found to be necessary, a simple remedy would be to rake up the leaves, including the cases, under the trees and burn them on the spot. Dr. Fletcher, in his Report for 1885, records an attack by this insect on maple trees in the neighborhood of Ottawa, and also relates a similar visitation in Missisquoi County, P. Que,, described by the Rev. Dr. Fyles in the year 1881.

The Spruce Gall-louse (*Chermes abietis*) Fig. 17, has become a serious enemy to spruce trees and is causing much trouble and anxiety to the growers of these ornamental trees in many parts of the Province. It is very abundant at Guelph, Galt, Minden, Chatham and various other places. As it has frequently been described and referred to in these Annual Reports, it

FIG. 17.—Spruce Gall-louse. *a*, summer form of nymph; *b*. affected twig.

may suffice to mention now that good results have been obtained by spraying affected trees at the time the young plant-lice are exposed with a tobacco and soap wash or with kerosene emulsion. This should be done in May when the young lice emerge from the eggs and before they are enclosed in the galls, and also towards the end of August when the winged forms come out of the galls. The terminal shoots should be watched at those times and the spraying performed as soon as any of the insects are to be seen moving about. They are so minute that a magnifying glass will be required to see them. The spraying should be repeated two or three times at short intervals, as the insects do not all come out at the same time.

The Larch Saw-fly (*Nematus Erichsonii*) is still to be found here in a small plantation on the College premises. Towards the end of July full-grown larvae were found, which assumed the chrysalis stage a few days after they were collected (July 23). There had evidently been a serious attack in the spring, as nearly all the boughs had a very short and scanty clothing of light green foliage, contrasting strongly with the deeper hued and much longer needles on the branches that had not been defoliated. The ground

beneath the trees was covered with the old droppings from the caterpillars. This plantation has been repeatedly sprayed in previous years, but the insect is very far from being exterminated. Its ravages in the Province of Quebec are graphically described by Dr. Fyles in another part of this Report.

Spittle insects (*Aphrophora*) were abundant this summer on some Scotch Firs and also upon grass in pasture fields—no doubt different species. The masses of white froth, resembling spittle, were very conspicuous, each one containing the strange larva which produces it. The adult bugs were to be found in numbers on the Fir trees later in the summer. No serious damage was done in either case, though no doubt an extensive attack must reduce the vitality of a tree, and in a pasture the presence of the frothy masses would be very distasteful to the feeding cattle.

The Fall Web-worm was very abundant again this year. It is so conspicuous and so easily got rid of, a whole colony at a time, that there is surely no excuse for its increase and prevalence. The very unsightliness of the webs, with their foul masses of excrement and cast-off caterpillar skins, ought to be enough to cause every one with a spark of tidiness in his composition to clear at least his own trees and induce his neighbors to follow his example.

INSECT GALLS OF ONTARIO.*

By Tennyson D. Jarvis, Ontario Agricultural College, Guelph

I am under obligations to numerous friends and correspondents who have aided me in this work. I am especially indebted to Mr. W. R. Thompson, O. A. College, for the assistance he has rendered in the preparation of this work. I am under obligations to the Department of Entomology, Washington, D.C., Dr. Bethune, Dr. Fletcher, Prof. Lochhead, Mr. J. Eaton Howitt, Mr. C. W. Nash and Mr. Douglas Weir for the assistance they have given me.

Among the many curious phases of insect life, and among the many wonderful illustrations of the effects of evolution upon organized structures with which we meet in the study of entomology, there are few examples which present such varied and interesting peculiarities of structure and development as do insect galls. Varying as they do from such simple malformations as the curled leaves produced by the work of aphids to such beautiful and complex structures as the oak-apples and oak twig-galls, they present a succession of types which show in a peculiar and wonderful manner the changes in structure of insect and plant induced in the struggle for existence. A gall may be briefly defined as a malformation of plant tissue induced by mechanical or chemical stimulus or by some other unknown cause. These are sometimes produced by fungus, but those with which we have to deal are produced in different ways by the work of insects. The habit of gall-making seems to have arisen at different times and in entirely different orders and families of insects, and even a branch of the order Acarina has acquired this gall-making habit. In each case, however, it has developed along lines which depend directly upon the structure of the insect, so that in many cases the classification of the insect can be considerably simplified by an examination of the gall. For instance, the Cecidomyiid, having an ovipositor incapable of piercing, lays its eggs upon the surface of the leaf,

*See plates at beginning of volume.

and the gall thus induced by the work of the larva is generally open; while the Cynipid, having a stinging ovipositor, deposits its eggs in the leaf tissue through a minute puncture, which, quickly healing, leaves the gall closed and the insect at maturity emerges through a hole which it cuts in the gall, which the Cecidomyiid, on account of its sucking mouth parts, is utterly unable to do. Here, moreover, we have an explanation of the apparently contradictory fact that Cecidomyiid galls are sometimes closed, because whenever we find this condition we invariably find the gall splitting open at maturity. The reason for this in all probability is that the larva entering the tissues makes a much larger incision than the minute puncture induced by a Cynipid's ovipositor, and this, never completely healing, splits open when the tissues commence to dry up in autumn. Similarly in other orders the structure of the gall-maker determines the form of the gall.

These abnormal growths have long been noticed and commented upon. The earliest authentic work upon the subject was by Malphigi. In 1686 he published his "De Gallis," containing descriptions of a number of galls common to Italy and Sicily. In America the subject was first taken up by Osten Sacken, Walsh, Basset, Riley, Harris, and a few others who have laid the foundations for most of our work on galls. Now a large number of writers, among whom may be mentioned Ashmead in Hymenoptera, Pergande in Hemiptera, Garman in Phytoptidae and Norton in Nematinae. A host of European writers have also taken up the subject, but in this country there still remains an enormous amount of work to be done even in classification, while the morphology and histology is practically an unexplored territory.

The insects producing galls are confined principally to four orders, the Acarina, which are not true insects but mites, the Diptera or flies, the Hemiptera or bugs, and the Hymenoptera including two families, the Tenthredinidae and Cynipidae, and to a slight extent the Chalcididae. It is a curious fact that the insects which are of the most developed and specialized structure, produce the most complex galls. That is, in the lower orders, as Thysanura, the orders formerly included in Neuroptera, Orthoptera, and other orders, we find no gall-making habits; while in the Diptera, Hemiptera and Hymenoptera, and to a slight extent in the Lepidoptera and Coleoptera we find the habit developed. This curious coincidence may be possibly explained thus—if, indeed, the lower and less specialized forms which came into existence in an earlier age when a lower and now extinct type of vegetation flourished, ever produced forms with the habit of gall-making, these forms probably perished with the flora of that age, while the later forms which now produce galls were evolved at a much later period when the flora resembled that of the present age.

The orders of insects among which we find the greatest number of gall-producing insects are the Hemiptera, Diptera and Hymenoptera, and to some extent the Coleoptera and the Lepidoptera. The order Acarina in the class Arachnida contains the family Eriophyidae or gall-mites. These are also specialized forms, inasmuch as acaralogists seem to be unable to agree upon their relationship to other Acarina.

Acarina.

Family Eriophyidae, Gall-Mites.

This is a family of microscopic mites which are quite curious and unusual in structure. They have only two pairs of legs and the abdomen is long and striated. These striations, which differ in the different species, and differ in number on the dorsal and ventral surfaces, are of considerable

value in classification. The galls produced vary in form, but are always open or provided with an opening through which the mites pass in and out. They are generally lined with minute hairs or granules, and are quite simple in structure. Reproduction takes place within the gall.

Coleoptera.

Family, Buprestidae. Metallic Wood Borers.

This is a family of the beetles containing insects whose larva bore in wood of trees and shrubs. A few produce galls, the most important one being the Red-necked Agrilus producing galls upon the Raspberry and Blackberry canes.

Lepidoptera.

Super-family, Tineidae. Leaf miners and clothes moths.

This family is very large and the larvae are mostly plant feeders. The adults are minute moths with narrow wings bordered with wide fringes. The family contains but few gall-makers.

Hemiptera.

Family, Aphididae. Aphids or plant lice.

These are small, soft bodied insects which suck up the juices of plants and which often produce galls. There are winged and wingless forms, the wingless forms reproducing parthenogenetically. The galls produced vary in form from mere leaf curls to forms of most curious appearance but of quite simple structure. They are all open or furnished with an opening, and large numbers of the aphids can be found if the gall is opened.

Family Psyllidae. Jumping plant lice.

The members of this family resemble the preceding to a great extent, but they are not so numerous. The hind legs are formed for jumping.

Diptera.

Family, Cecidomyiidae. Gall gnats.

These insects in the adult stage are rarely seen. They are very delicate, small, two-winged flies and with few veins in the wings and with sucking mouth parts. The eggs are laid upon the leaf surface and the larva either feeds there, making an open gall, or makes an incision in the leaf and enters, forming a closed gall, which splits open at maturity at the point where the larva entered. The larvæ can generally be readily identified by their color, which is orange, red or pink, and by the development between the second and third segments of the body of a peculiar horny projection called the breast-plate, the use of which is not definitely known.

Sub-family, Trypetinae.

These flies are much larger than the preceding, but few of them produce galls. Two species, Trypeta polita and Trypeta solidaginis, produce galls upon the goldenrod. The adults are pretty flies with banded wings.

Hymenoptera.

Family, Tenthredinidae.

In this family the Nematinae produce galls. The head and thorax are wide. The base of the abdomen is broadly joined to the thorax, and the abdomen of the females is furnished with a pair of saws. The larvae have from twelve to sixteen prolegs. These insects have been very thoroughly taken up by Norton in his monograpn on Nematinae. A large number make galls on Willows.

Family, Cynipidae. Gall flies.

This is a family of very minute, four-winged insects. In the adult gall fly the abdomen is unusually compressed and joined to the thorax by a short peduncle, the first abdominal segment. The first segment is large and the remaining ones are short and each is more or less covered by the preceding. The ovipositor is long and slender. The insect deposits its eggs within the tissues of the plant by piercing it with its ovipositor. The wings have few veins and the fore-wings lack the stigma. The galls produced are closed and the insect emerges at maturity through a hole which it cuts in the gall. One of the most interesting features of insect life that has been discovered was noticed by Bassett and confirmed by Adler in regard to these insects. By careful investigation he discovered that two generations of these insects were produced every year, each of which produced a different sort of gall, and which could not be recognized as the same species. There is still, however, an enormous amount of work to be done upon this subject in America.

ERIOPHYIDAE.

Eriophyes quadripes. Produces top-shaped galls on the upper surface of the leaves of soft Maple. The galls are greenish at first, then become red, or purplish and finally dark brown. In the younger galls the inside wall is fairly smooth and the interior is hollow. As the galls grow older, irregular and somewhat granular excrescences appear on the interior wall and grow toward the centre until in the older specimens the interior may become quite full. It occurs on Soft Maple (*Acer dasycarpum*). Very common.

Eriophyes acericola. The mature galls are green and resemble in form and position the summer cases of the cigar-case-bearer. The interior wall is granular and parallel excrescences are found, but even at maturity they do not extend to the centre of the interior as in the case of E. quadripes. Occurs on Hard Maple (*Acer saccharum*). Very common.

Eriophyes abnormis. Produces balloon-shaped galls on the upper surface of the leaf. The apex of the gall is usually serrated. The interior has ridges projecting inward and the folds in the old galls nearly fill the cavity. Occurs on Basswood (*Tilia Americana*). Very common.

Eriophyes ulmi. The galls are intermediate in form between those of the Hard and Soft Maples and somewhat balloon-shaped. The interior wall is ridged vertically. The galls usually occur on the upper side of the leaves. Occurs on Soft Elm (*Ulmus Americana*) and Rock Elm (*Ulmus Racemosa*). Very common.

Eriophyes sp. Produces irregular wart-like swellings on the upper surface of the leaves of the Manitoba Maple. The swellings are green at first but turn gray when mature. The average diameter of the gall is about 3 m.m. The under surface of the galls appears as irregular concavities lined with a granular secretion, which is greenish at first and rusty brown when old. Occurs on Manitoba Maple (*Acer negundo*). Common.

Eriophyes phloecoptes. Produce tubercular gall masses which encircle the base of the buds and shoots of the cultivated plum. The galls are about one-sixteenth of an inch in diameter, and the interior is granular with a small cavity in the centre. As many as sixty-two of these mites were found in a single gall. Occurs on cultivated Plum (*Prunus domestica*). Not common.

Eriophyes sp. This species produces an abnormal growth of the buds of the Yellow Birch. The terminal growth of the twig is checked and large bunches of buds are formed sometimes as large as a hen's egg. The galls remain on the tree, giving the tree an unsightly appearance in winter. Occurs on Yellow Birch (*Betula lutea.*) Common.

Eriophyes pyri. Produces blister-like swellings on the leaves of the Pear and Apple. The blisters are reddish brown in May, green in June, and dark brown or black in the latter part of June. The blisters usually run together, forming irregular blotches over the upper surface of the leaf. Occurs on Pear (*Pyrus communis*) and Apple (*Pyrus malus*). Very common.

Eriophyes sp. This gall is green and red and about 2 c.m. in length. It consists of a fold of the leaf making a long, irregular, wavy projection on the upper surface of the leaf. From beneath this appears as a serpentine incision in the leaf. It is about 2 m.m. high. It is hard and roughened on top. From the midrib to the edge of the leaf is the general direction of the gall. Occurs on Hawthorn (*Crataegus sp.*). Common.

Eriophyes sp. Produces galls about 2.5 m.m. in length by 1.5 m.m. broad. It is joined to the leaf by a constriction. Externally it is red and pubescent. Inside gall is full of granular material and contains numerous mites. Occurs on Speckled Alder (*Alnus incana*). Common, especially upon the leaves of the bushes at the water's edge.

Eriophyes sp. This mite produces galls of the typical Eriophyid shape upon the leaves of the Paper Birch. The galls are yellowish or reddish, joined to the leaf by a constricted neck and rather smaller than usual, being about 2 m.m. long by 1 m.m. broad. They appear on both upper and under sides of the leaf, and when found upon the under side, hairy. The opening on the opposite side through the leaf lined with white hairs.

Parasitic mites attack this species and often they are found to have devoured or driven out all of the gall makers. Occurs on the Paper Birch (*Betula papyrifera*). Common.

Eriophyes salicola Garman. The gall is irregular, roundish and serrated, with a roughened top, projects about 1.5 m.m. from the surface of the leaf, slightly constricted where it joins the leaf. From 1-4 m.m. in diameter. On the under side there is sometimes a small projection and sometimes a cup-like cavity in which are seen the roughened portions of the under side of the gall. When the gall is mature, it is filled with granular excrescences and hairs growing from the interior walls. The gall is green or red and distributed over the upper or lower surface of the leaf. Occurs on *Salix Alba, Salix balsamifera, Salix discolor, Salix rostrata.*

The description was taken from Galls on Salix balsamifera.

Eriophyes sp. This mite produces dimples on the leaves of the Aspen on the upper side lined with spherical granules, reddish or greenish in color. These consist of soft parenchymatous tissue upon which the mites feed. The galls are fairly uniform in size, being about 2 to 3 m.m. in diameter. The galls are green in color and occur three or four to a leaf. Occurs on Aspen (*Populus tremuloides*). Common.

Eriophyes sp. The galls consist of irregular projections on the upper or under side of the leaf and are quite generally distributed in patches, 4-5 m.m. in length or even 1.5 c.m. They project about 1-1.5 m.m. above the leaf. On the under side they appear as irregular cavities lined with white vegetable hairs. The galls are green in spring, turning red later in the season. Occurs on Poison Ivy (*Rhus toxicodendron*). Common.

Eriophyes sp. This gall consists of a small circular depression averaging about 2 m.m. in diameter and always depressed on the lower side of the leaf. On the upper side it appears as a green or red circular elevation. The gall is lined with minute spherical granules composed of soft parenchymatous tissue. Occurs on large-toothed Aspen (*Populus grandidentata*). Common.

Eriophyes sp. This gall is so different in structure from the typical Eriophyes fraxini gall that I have no hesitation in placing it as a different species. The galls are produced almost invariably along the principal veins. Dorsally they are light pinkish white in color, about 2.5 by .75 m.m. and growing on either side of the vein. The surface of the gall is transversely seamed and irregular. It lies in a one-sided position upon the leaf. Ventrally the galls appear as white, hairy projections following the veins. The opening runs the full length of the gall and is lined with white, hairy tissue. The mites are exceedingly numerous, more occurring to a gall than of any other species. They can easily be detected with a hand lens and are brown in color. The interior of the gall is lined with soft tissue. Occurs on White Ash (*Fraxinus Americana*). Not common.

Eriophyes sp. This gall is a pouch-like growth on the upper side of the leaf. It is distinguished from *E. serotinae* by the fact that it has not the funnel-like opening of that gall. It is green or reddish, about .5-.7 cm. in length and 3 m.m. in diameter at its widest part. Near the leaf it is constricted to about 2 m.m. in diameter. The interior of the gall is lined with small granules and among these the gall mites feed. The gall opens on the under side by a minute aperture about 1 m.m. in diameter lined with fine white hairs. Occurs on Chokecherry (*Prunus virginiana*). Common.

Eriophyes sp. Only one specimen of this gall was found. It is of the same type as the gall on Chokecherry, but rather longer and narrower. It is green in color and the inside is lined with rough juicy tissue. Only two mites were found in the gall, near the opening. Occurs on Wild Plum (*Prunus Americana*). Not common.

Eriophyes querci. This is an irregular dimple upon the blade of the leaf. It is of the same color as the leaf when young, but turns yellowish red with age. From beneath it appears as an irregular concavity, lined with a tangled mass of white vegetable hairs. Among these abnormal hairs are the mites, which feed upon the tissue and produce the gall. The gall is 3 to 5 m.m. in diameter. Occurs on Bur Oak (*Quercus macrocarpa*). Common.

Eriophyes serotinae. This gall is pouch-like. It occurs upon the upper side of the leaf with a deep funnel-like opening beneath. The gall is about .5-.6 cm. in length and consists of a pouch-like hollow growth on the upper side of the leaf constricted about half way to the leaf. The interior of the gall, which is green or red and green, is covered with minute granulations, which seem to be the food of the mites producing the gall. The distinguishing character of the gall is the deep funnel-like opening beneath lined with hair through which the mites pass in and out. Occurs on Black Cherry (*Prunus serotinæ*). Common.

Eriophyes sp. The gall made by this species of Eriophyes consists of a small round swelling which protrudes very slightly on both sides of the leaf. This is about .5-1 m.m. in diameter, green in color in spring, and turning brown in summer and autumn. The galls are very numerous where they occur, and as many as 100 are sometimes found on a single leaf. The gall contains numerous mites, which feed in the irregular cavities in the gall. Occurs on the spotted Hawthorn (*Crataegus punctata*). Not common.

Eriophyes sp. Red patches are found upon the upper sides of the leaves of Maples, resembling hoar-frost. Under the microscope, it is seen to consist of minute pink balls, joined to the leaf by a constricted neck and occurring in such numbers as to appear like red frost. Occurs on Hard Maple (*Acer saccharum*). Common.

Eriophyes sp. It differs from the frost mites on Hard Maple and Beech in that it does not consist of a mass of spherical granules, but of a mass of tangled threads which under the lens are seen to be arranged in very beautiful star-like clusters. The mites are easily found among these. The patches are found on the under side of the leaves betwen the ribs. Occurs on Rock Elm (*Ulmus racemosa*). Common

Eriophyes sp. The structure of this frost mite gall is much the same as that of the red frost mite, but the mass of excrescences is thicker, white in color and produced upon the under side of the leaf. Occurs on Hard Maple (*Acer saccharum*). Common.

Eriophyes sp. The gall consists of a mass of tangled white vegetable hairs. The growth is very much the same in general appearance as the one producing the "frost" and "down" on Rock Elm and Beech. The mites are quite small and difficult to locate, as they are much the same in color as their surroundings, and remain down in the lower part of the gall near the leaf. The gall is found on the lower side of the leaf, a common place is in the axils of the veins. Occurs on Mountain Maple (*Acer spicatum*). Common.

Eriophyes sp. The work of this mite is very commonly seen. It appears upon the leaves of Beech quite early in the season. The presence of the mite is shown by large irregular white masses on the under surface of the leaves which have a glittering appearance resembling hoar frost. Under a microscope, this appears as a mass of innumerable, minute, spherical granules. Among these are the mites, which are few and very difficult to locate. The upper surface of the leaves upon which the frost mite is working are discolored and in some cases distorted. Occurs on Beech (*Fagus sylvatica*). Very common.

Eriophyes sp. This consists of a mass of minute, yellowish, transparent, granular bodies upon the leaf, growing together in such numbers as to form large patches of frost running between the ribs, which hide the leaf. The patches vary from 1 cm.-3 cm. in length and from .25-1cm. in diameter. Among these granules are the mites which are extremely minute, the smallest of all the mites yet examined. Occurs on Paper Birch (*Betula papyrifera*). Common.

Eriophyes vitis. These are typical Eriophyid galls about .5 cm. in length by 2.5 m.m. at the widest portion to 1 m.m. at the constricted portion near the leaf. The top of the gall is irregular, being much in appearance like *Eriophyes abnormis*. The interior and the entrance to the gall is lined with white vegetable hair. The galls are green in color and grow mostly upon the under sides of the leaves, with the opening upon the upper side. Occurs on Wild Grape (*Vitis cordifolia*). Not common.

Eriophyes fraxini. The galls produced by this species of mite are found upon several species of Ash, and vary somewhat in structure according to the leaf upon which they are found, upon Red Ash being hairy, upon White Ash glabrous, etc. They consist of somewhat irregular circular swellings from 2-4 m.m. in diameter which protrude upon both sides of the leaf. Sometimes they occur only 10 to a leaf, but sometimes as many as 75 are found, entirely covering the surface of the leaf and so interfering with its functions as to injure the tree upon which the galls occur. The surface of the galls is rough. Several often unite, to form a large irregular patch. On the under side are the minute, hairy-lined openings into the galls. The galls are hollow, thick-walled, and lined with numerous granular excrescenses and irregular growths. The gall is of a lighter green than the rest of the leaf. Occurs upon White Ash (*Fraxinus americana*) and Red Ash (*Fraxinus pubescens*). Common.

Eriophyes sp. This is one of the "frosts" produced by the work of the mite upon the leaves. The patches of frost are pure white in color, and occur on the under side of the leaves, in the axils of the veins. Under the microscope, these patches of "frost" appear as dense masses of thick transparently white hairs. The patches vary in size from 4-10 m.m. On the leaves of *Alnus incana.* Not common.

Eriophyes sp. This consists of a dense mat of brown hairs growing in large patches upon the under sides of the leaves. Above, the leaf appears lighter in color and rather abnormally shiny where the gall mites are working beneath. On *Quercus coccinea.* Common.

Eriophyes sp. Circular, flat, or slightly convex patches varying from 2-3 m.m. in diameter on the upper side of the leaf, the under side being covered with minute granular excrescences, which vary from white to dark brown in color. On *Populus grandidentata.* Common.

Eriophyes sp. Irregular patches of frost, transparently white in color and appearing as a mass of minute granules. Under the microscope similar to the frost upon the Beech and Maple. Occurring upon the surface of the leaves. Occurring upon the leaves of the Low Birch (*Betula pumila*). Uncommon.

Eriophyes sp. Similar to the above but rosy pink in color, and occurring in much larger patches, upon the upper side of the leaves. On *Betula lenta.* Common.

Eriophyes sp. These galls are produced upon the Soft Elm, and when young bear some resemblance to the typical mite gall of the Elm (*Eriophyes ulmi*), but the distinguishing peculiarity of these galls is that they grow until they reach a size far exceeding that of any *E. ulmi* yet observed, sometimes attaining a length of 2 by 1.5 cm. The development of the galls also differs from that of *E. ulmi*, which commences as a button with a constricted neck, while this gall often commences as a cone, or deep dimple. On Red Elm (*Ulmus pubescens*). Not common.

HEMIPTERA.

Spruce Gall-louse (Chermes abietis).

These galls are greenish swellings, occurring on the twigs of various species of Spruce and sometimes in immense numbers. The galls are polythalamous, containing from three to thirty cavities within each of which live twenty or thirty minute yellowish insects. In July the galls dry up, and the cavities open, allowing the lice to escape. These molt and some of them assume wings. This gall-louse is one of the worst pests of Spruce trees known. In many parts of Ontario nearly every tree is abundantly covered with this gall, and the insects do great damage by sucking the juices of the tree. Occurs on White, Black and Norway Spruce—*Picea alba, Picea nigra and Picea excelsa.* Very common.

Vagabond Gall (Pemphigus vagabundus).

Produces large irregular galls on the tips of the twigs. It is a monothalamous gall consisting of a double lamina, and between these two layers are large numbers of aphids. The gall usually remains on the tree over winter. Occurs on the Cottonwood (*Populus deltoides*). Common.

Cockscomb Gall on Elm (Colopha ulmicola Fitch).

A hollow, cockscomb, thin-walled gall on the leaf of the American Elm. Occurs on the upper side of the leaf. The apex of the gall is serrated and the sides grooved. The gall appears inflated. The opening is on the under side of the leaf, running the full length of the gall. The in-

terior contains numerous aphids in July and June. The gall is 1.5-2 cm. long by 1 cm. high. Occasionally a number occur on a leaf side by side. It is constricted near the base. Occurs on American Elm (*Ulmus Americana*). Common.

Spiny Witch-Hazel Gall (*Hormaphis spinosus*).

This gall is round, covered with long spines. It is a deformation of the fruit bud. The spines are covered with little clusters of hair like those on a cactus leaf. In it are many small aphids, brown in color. The opening to the gall is at the base, near the stem of the gall by which it is joined to the branch. Green in summer, woody and hard in winter. Occurs on Witch-Hazel (*Hamamelis virginiana*). Common.

Witch-Hazel Cone Gall (*Hormaphis hamamelidis*).

This gall is cone-shaped, about 5 m.m. in length by 3 m.m. in diameter. It occurs on the upper side of the leaves, with the opening through a small hole in a slightly projecting cone on the under side of the leaf. The opening is about 5 m.m. in diameter. The gall is hollow, containing numerous aphids which are white in color. Occurs on Witch-hazel (*Hamamelis virginiana*). Common.

Poplar Stem Gall (*Pemphigus populicaulis*).

An irregularly spherical gall developed at the junction of the petiole and blade of leaf. The opening is as wide as the gall and is at one side of the base of the pouch. It is hollow, about 11 m.m. in diameter, containing large numbers of aphids. Occurs on Cottonwood (*Populus deltoides*). Common.

Hickory Cone Gall (*Phylloxera Caryae-fallax*).

This is a cone-shaped gall about 3 m.m. in diameter which occurs rather uncommonly on Hickory in this district. The gall is on the upper surface of the leaf, the opening being in a smaller cone upon the under surface. The gall is monothalamous, and contains numbers of small white aphids. It is green in color, and the opening is fringed with hairs. Occurs on Shell-Bark Hickory (*Carya alba*). Not common.

Vein Gall on Hickory (*Phylloxera caryaevenae*).

This gall consists of a fold of the main veins running from the midrib to the edge of the leaf. Above it is ribbed by the vein running along it. It is 5 m.m.-1 c.m. in length and 1-1.75 m.m. wide and 1.5-3 m.m. high. The galls are red. From the ventral side they appear as slits along the vein, lined with white thick hair. The gall is hollow and contains eggs, small aphids and a stem mother. The eggs are oval and transparently white and the gall is grooved inside, evidently for the purpose of holding them. The galls begin to appear in May, and are mostly empty by August. The larvae, according to Pergande, conceal themselves in cavities of the bark, or in deep depressions in the trunk and stem after leaving the gall, where they feed upon the juices of the tree. Occurs on Shell-Bark Hickory (*Carya alba*). Not common.

Cottonwood Midrib Gall (*Pemphigus* sp.)

A somewhat elongated pouch-like gall of aphid origin growing on the midrib of the leaf of the cottonwood, about halfway between the base and the apex of the leaf, and never on the leaf at the junction of the petiole and blade like *P. populicaulis*. Also instead of being irregular globular as is the latter, this gall is pouch-shaped, about 1-1.5 c.m. broad. Occurs on Cottonwood (*Populus deltoides*). Common.

Hackaberry Nipple Gall (Pachypsylla celtidis-mammae).

A woody gall with bluntly rounded apex and slightly constricted at the point of attachment to the leaf. It is found on the underside of the leaf and opposite the gall is a concave depression. Occurs on Hackberry (*Celtis occidentalis*). Common.

Hackberry Blister Gall (Pachypsylla celtidis-vesiculum).

Circular spot-like galls on the under side of the leaf with a small nipple in the middle. Occurs on Hackberry (*Celtis occidentalis*). Common.

Sumac Tomato Gall (Pemphigus rhois).

Large, smooth, rounded galls, somewhat resembling a tomato in shape. Yellowish green in color and sometimes tinged with red. The interior is hollow and filled with lice. Occurs on Sumac (*Rhus typhina*). Common.

Woolly Aphis Gall of Elm.

The lice may be seen in large clusters on the trunk and branches of the tree. They suck the juices from the bark and cause knot-like swellings to appear. These galls sometimes attain a diameter of two or three inches. Occurs on many species of Elm (*Ulmus sp.*). The one from which this gall was described was a young American Elm (*Ulmus Americana*). Common.

Woolly Aphis of Apple.

This species of woolly aphis live in small colonies and produce small swellings on the young twigs. The galls often become twice the diameter of the stem upon which they are feeding. Occurs on Apple (*Pyrus malus*). Common.

Grape Phylloxera (Phylloxera vastatrix).

Small galls on either upper or lower surface of the leaf. Another generation of this insect forms galls upon the roots, and it is in this stage that it causes considerable destruction among the cultivated varieties. Occurs on wild and cultivated Grapes. Very common on Wild Grape (*Vitis vulpina*).

LEPIDOPTERA.

Elliptical Goldenrod Gall (Gelechia gallaesolidaginis).

A large elongated stem gall. It is about one inch in length and monothalamous. The larval chamber is quite large. It remains over winter in the pupal stage and the imago emerges in the spring. Occurs on Goldenrod (*Solidago sp.*). Common.

The Locust-Twig Borer (Ecdytolopha insiticiana).

Oval swellings on the branches and twigs, varying from 2-4 cm. in length and about a cm. in thickness. Generally occurring at the junction of the leaf petiole with the branch, about which point the wood is destroyed and a mass of castings and sawdust surrounds the hole entering the gall. The tunnel of the gall maker runs some distance, and at the bottom of it is a reddish-brown larva about half an inch in length with a light-brown head.

COLEOPTERA.

Willow Branch Gall (Saperda concolor).

Large, rough galls on the stems of the willow and cottonwood. The galls are smooth at first, but become rough later in the season. The affected portions are very weak and easily broken off by the wind. Occurs on Willows and Cottonwood. Common.

Red-necked Blackberry-borer (Agrilus ruficollis).

Symmetrical swellings of the Blackberry cane. The gall is about one-third greater in diameter than the normal cane. The larva makes a channel in the centre of the gall. Occurs on Blackberry. Not common.

DIPTERA.

Vein Gall of Blue Beech (Cecidomyia pudibunda).

This gall consists of a fold of the leaf along the veins. It is not very much thickened and is generally constricted near the leaf, forming a long, hollow tube. The opening to the gall is on the underside and runs the full length of the gall. It is lined with white pubescence in much the same way as the Phylloxera on Hickory. Inside the gall, which is hollow, are found a few very small orange-colored larvæ. The gall is quite red in color. Occurs on Blue Beech (*Carpinus Caroliniana*). Common.

Ball Gall on Wood Nettle (Cecidomyia urnicola).

This gall is somewhat similar in structure to the gall on the fruit of the wood nettle, but is much smaller, much lighter in color and uniformly monothalamous, whereas the gall on the fruit is sometimes polythalamous. The larvæ are also somewhat smaller than those on the fruit. The galls occur either on the upper or lower surface of the leaf. Numerous small inquiline Hymenoptera were hatched from this gall. There is no opening in the gall. Occurs on Wood Nettle (*Laportea Canadensis*). Common.

Pine Cone Willow Gall (Cecidomyia strobiloides).

A mass of closely imbricated leaves at the end of a twig, caused by the arrest of growth at the end of the stem. Regularly cone-shaped. In the centre, surrounded by a thin, transparent covering, is a small orange larva. Occurs on Salix discolor and many other species of scrub willows. Common.

Oak Fold Gall (Cecidomyia niveipila).

Consists of a dense white pubescence upon the under side of the leaves, causing a distortion and folding of the leaf blade. The pubescence is inside the fold, forming the lining of the gall. Occurs on Red Oak (*Quercus rubra*). Common.

Wild Cherry Bud Gall (Cecidomyia serotinae).

A club-shaped, monothalamous gall with one or two leaves growing from its sides. The gall is an enlargement of the terminal buds of young shoots of the Wild Cherry. Occurs on Black Cherry (*Prunus serotina*) and Chokecherry (*Prunus virginiana*). Common.

Eye Spot Gall of Maple (Cecidomyia ocellata).

This is a dimple gall surrounded by an areola. At first the gall is entirely green, but at maturity the nipple turns a rich red, the areola surrounding it becomes light yellow in color and a thin line surrounding this turns deep pink in color. The successive rings of color very much resemble a target. In the cavity formed by the underside of the gall rests a small white larva, covered with a viscid secretion. Later in the season the gall turns black and drops out, leaving a circular hole.

This gall has been usually placed as Sciara ocellata, but most authorities, including Osten Sacken himself, now place it as Cecidomyia, attributing the presence of the Sciara to an error in the rearing. Occurs on Red Maple (*Acer rubrum*) and Soft Maple (*Acer dasycarpum*). Common.

Grape Vine Tube Gall (Cecidomyia viticola).

A long conical, cylindrical tube-shaped gall, about .7-1 cm. in length by 1.5-2 m.m. in diameter near the base, where it is attached to the leaf by a slight constriction. It tapers to a point at the tip. Monothalamous, containing several minute larvæ. It is green or bright red in color and occurs on the under side of the leaf. Occurs on Wild Grape (*Vitis sp.*). Not common.

Basswood Wart Gall (Cecidomyia verrucicola).

Small swellings on leaf of basswood, appearing in May or June. About 3 m.m. in diameter, protruding from both sides of the leaf about 1 1-2 m.m. The upper side has a dimple in the centre. Red above and green below. Open in the fall by means of a circular lid upon the underside. Contains small larvæ. Occurs on Basswood (*Tilia Americana*). Very common.

Burr Gall on Hawthorn (Cecidomyia bedeguar).

This is a small cylindrical gall, hollow, red or green in color, about 3 m.m. in height and diameter, and with a hole in the top of it. The top of the gall around the hole is thickly set with spines, making the gall look somewhat like a burr. Inside it are found many small orange-colored larvæ about 1.5 m.m. long. It is monothalamous and occurs on the upper side of the leaf. Occurs on Hawthorn (*Crataegus sp.*). Common.

Cherry Pocket Gall (Cecidomyia virginiana).

This gall consists of a malformation of the fruit. The pit or stone is absent and the fruit is enlarged, forming a thick-walled pouch about 1 cm. in length by 5 m.m. in width by 1.5 m.m. in thickness. The gall contains from 10 to 15 larvæ. It has no opening, but later the fruit becomes loosened from the peduncle and leaves an opening. The larvæ leave the gall in June or July. Occurs on *Prunus virginiana*. Very common.

Ash Midrib Gall (Cecidomyia pellex).

This gall is caused by a swelling and folding of the midrib of the leaflets, the thickening being greatest at the midrib and extending towards the edges of the leaf, often involving nearly the whole of it. The thickened portion is folded together, giving the leaflet the appearance of a bean or pea pod. A small cavity is left at the bottom of the gall which runs the whole length. In this cavity are found minute larvæ, feeding on the green succulent tissue of which the gall is composed. The underside of the leaf is always the outside of the gall. Occurs upon the leaflets of White Ash (*Fraxinus Americana*). Not common.

Box Elder Midrib Gall (Cecidomyia negundinis).

Swellings on the midrib of the leaflets of the Box Elder, much resembling *Cecidomyia pellex* on the White Ash. The swellings form two long circular chambers, one on either side of the midrib, opening on the upper surface by slits running the whole length of the gall. Occurs on Box Elder (*Acer negundo*). Not common.

Ball Gall on Hickory (Diplosis carya).

Thin-walled galls, about 3 m.m. in diameter, hard and brittle, attached to the underside of the leaves of *Carya alba* by a projection at the base, which appears upon the upper side as a black dot, surrounded by a light yellow areola. The gall has no opening and contains a very small larva. The hypertrophy is monothalamous. The exterior of the gall is smooth or slightly pubescent. Occurs on *Carya alba*. Common.

Tulip Tree Midrib Gall (Cecidomyia tulipifera).

Hollow swellings, varying from .5 to 2.5 cm. in length by 3-4 m.m. in width, on the midrib and lateral veins of the leaves of the tulip tree. Monothalamous. Occurs on Tulip tree (*Liriodendron tulipifera*). Not common.

Spiræa Pod Gall (Cecidomyia salicifolia).

The leaves are folded in such a way as to assume the appearance of a pod. The pod is formed by the folding of the leaf along the midvein, and the bulging out of the sac thus formed, the outer margin of which is closely united. The pods vary in size, the largest being about five-eighths of an inch long. Occurs on Spiræa (*Spiræa tomentosa*). Common.

Willow Club Gall (Cecidomyia rigida).

This gall is formed on the lateral shoots of the Bush Willow, an enlargement of the whole stem, tapering from the centre to both ends. Occasionally galls are found having terminal shoots growing from them. The gall is about three-quarters of an inch long. Occurs on several species of Bush Willow (*Salix sp.*).

Goldenrod Bunch Gall (Cecidomyia solidaginis).

It is found on the main stalk of Goldenrod. An apical gall which prevents the natural elongation of the stem. This unnatural accumulation of several hundred leaves into a globular mass is the result of injury to the terminal bud and consequent arrest of growth in length. Occurs on Goldenrod (*Solidago sp.*). Very common.

Goldenrod Ball-Gall (Trypeta solidaginis).

This is a globular ball-like enlargement of the stem of Solidago, about 2½ cm. in diameter. Pithy in structure, hypertrophy monothalamous, the central cell irregular in shape and containing a large fat larva which develops into a fly with banded wings. It is green in summer and woody in winter. Occurs on Goldenrod (*Solidago sp.*). Very common.

Vein Gall on Oak (Cecidomyia quercus-majalis).

These galls are produced along the veins or the under side of the leaves of the Red Oak. They are, narrowly oval, inflated galls much like the Cecidomyia pudibunda on Carpinus. The surface of the gall is netted with veins. The wall is quite thin. The opening to the gall is upon the upper side of the leaf, and runs the full length of the gall. The gall is hollow and the interior wall smooth. Green or brown in color. Occurs on Red Oak (*Quercus rubra*). Not common.

Hickory Nut Gall (Cecidomyia caryæ-nucicola).

A malformation of the nut produced by a Cecidomyiid, resulting in the formation of large irregular knobs all over the husk of the nut, containing thickwalled cells. Hypertrophy polythalamous. Occurs on Hickory (*Hicoria Alba*). Not common.

Alder Bud Gall (Cecidomyia serrulata).

A rounded monothalamous bud gall, a deformation of the terminal bud of the Alder. Occurs on Alder (*Alnus sp.*). Not common.

Midrib Gall on Virginia Creeper (Cecidomyia sp.)

This gall is green and succulent. It forms along the midrib of the leaf and occasionally along the side veins. It is flat and generally double, that is, on both sides of the vein. It is on the under side of the leaf and is really an enlargement or thickening in a fold on the leaf near the midrib. It

varies from 1.5 to 4.5 cm. in length, and from .8-1 cm. in width and .4-.6 cm. in thickness. Through the gall runs a single chamber about 1 mm. in diameter. The opening to the gall runs the whole length of the gall and is on the upper side of the leaf. The opening is lined with minute white hairs. In the gall are minute orange larvæ about 1.5 mm. x .6 mm.-2 mm. Occurs on Virginian Creeper *(Ampelopsis quinquefolia)*. Common at Guelph.

Midrib Gall on Touch-me-not.

An enlargement of the petiole or midrib of the leaf, protruding on both sides of it and averaging about 1 cm. in length x .4 cm. in width. Green, smooth and monothalamous. A single chamber running the length of the gall and containing several minute white larvæ. Occurs on Touch-me-not *(Impatiens fulva)*. Common.

Fruit Gall on Wood Nettles.

This gall consists of a malformation of the fruit of the woodnettle and sometimes all the fruiting stem is covered with them. The gall is juicy and quite soft in structure and in shape is a long oval with a pointed apex and sessile. The hypertrophy is variable, being sometimes mono and sometimes dithalamous. In the larval chamber, which is about 1 mm. in diameter and surrounded by light colored tissue, are one or two small fat larvæ light brown in color. The larva is segmented and legless. The gall is about .5 cm. in diameter and 1 cm. in length. It is green in color. Occurs on Wood Nettle (*Laportea Canadensis*). Not common.

Willow Egg Gall (Euura ovum).

Oval galls on the sides of the twigs of the Bush Willow. The galls are hard and woody and usually the same color as the stem. Occurs on Bush Willow (*Salix sp.*). Common.

Dogwood Club Gall (Cecidomyia clavula).

The galls are club-shaped and about 2 cm. in length. Inside is an elongated channel containing a single larva. They are found on the terminal twigs and the color is about the same as the bark. Occurs on Flowering Dogwood (*Cornus florida*). Not common.

Oak Spangles (Cecidomyia poculum).

Saucer-shaped galls in clusters on the under surface of the leaf. Usually pale red in color. Occurs on White Oak (*Quercus alba*). Common.

HYMENOPTERA.

Acraspis macrocarpa.

This beautiful little gall occurs quite commonly upon the leaves of *Quercus macrocarpa* in this vicinity. It is small, average diameter 3 m.m., and in form globular to oval. Above, it is bright red, fading to yellowish green near the base, where it is joined to the leaf by a small portion of the surface so that it is easily detached without injuring the leaf. The surface of the gall is netted with innumerable fissures, between which are small elevations with very short spines. When on the underside of the leaf the gall is white in color. It is monothalamous and the smooth, hollow chamber contains a single small white larva. The galls occur along the veins.

They much resemble *Cynips pisum*, but are monothalamous and also resemble *Cynips echinus*, but the spines on this gall are scarcely noticeable and *Cynips echinus* and *Cynips pisum* are both polythalamous. Occurs on Burr Oak (*Quercus macrocarpa*). Common.

The Oak Petiole Gall (Andricus petiolicola).

This is a midrib or petiole gall. It is hard and woody and projects on one side, generally on the lower. It averages 1.2 cm. by .7 cm. and 8 m.m. wide. It contains several cells lined with hard white tissue which in some cases are arranged like the seed cases in a core of an apple. In each of these is a small white larva, apparently legless, and covered with a viscid transparent secretion. The gall is green or red and more or less roughened on the outside. Occurs on White Oak (*Quercus alba* and *Quercus primoides*). Common.

Rose Root Gall (Rhodites radicum).

A smooth, irregularly rounded, brownish swelling upon the root of the Wild Rose. Reddish brown in color, quite light and pithy in structure and containing numerous cells. From 3 to 5 cm. in diameter. Occurs on roots of Wild Rose (*Rosa* sp.). Not common.

Spiny Ball Gall on Wild Rose Leaf (Rhodites bicolor).

This is a very beautiful little gall which is rare in this vicinity. It is monothalamous and is formed upon the leaf of the wild Rose and sometimes all the leaflets are transformed in this way. The gall is a thin-walléd ball, red or green in color and covered with short spines. It is monothalamous and contains one small larva about ¾ m.m. long. The gall is about .75 cm. in diameter. The wall is about ¾ m.m. thick. There is no opening. The inside is quite smooth. Occurs on Wild Rose (*Rosa sp.*). Not common.

Rose Stem Gall (Rhodites globulus).

This gall is found upon the stem of the Wild Rose. It consists of an abrupt corky enlargement of the stem. It is about 2-2.5 cm. in length and about 1-1.5 cm. in width. It is quite smooth on the outside, not at all pubescent, and green or red in color. A single long chamber runs longitudinally through the gall about 3 m.m. in diameter and irregular in shape. In this are small larvæ about 3 m.m. in length. The larva is dark grey with a lighter head and tail and is legless. Occurs on Wild Rose (*Rosa Carolina*). Not common.

Mossy Rose Gall (Rhodites rosæ).

It is composed of a mass of hard, small cells clustered around a branch or twig. These cells are covered with a dense thick mass of green filaments which grow from them. The gall is monothalamous and from 1.5-2 cm. in diameter. Occurs on Wild Rose (*Rosa Carolina*). Common.

The Larger Oak Apple (Amphibolips confluentis).

Thin walled and globular, about 4 cm. in diameter. Exterior surface smooth (not pubescent) and somewhat irregular. Interior filled with a spongy mass of fibres, very loosely attached to the exterior but tightly attached to an interior woody cell in which the larva lives. Green in the early part of the season, later turning brown and brittle. Generally produced on the upper part of the leaf from the end of one of the veins. Occurs on Red Oak (*Quercus rubra*) and other closely related species. Common.

Hedgehog Gall on Oak (Acraspis erinacei).

A round or oval gall growing on the midrib of the leaf. About 1 by 5 c.m. The gall is white or yellowish and covered with fine bright pink or red spines about 1-2 m.m. in length. Attached to the leaf at a point about

the middle of the under side of the gall. Hypertrophy polythalamous. Larval chambers about 1-2 m.m. in diameter. It is found on the upper side of the leaf. Occurs on White Oak (*Quercus alba*). Common.

Furry Ball Gall on Oak (Neurotus floccosus).

This is a small spherical gall about 3 m.m. in diameter, which occurs on White Oak on the veins of the leaves upon the under side of the leaf. The gall is thickly covered with fine short hair which forms a cushion all round it. The gall is rather hard, and in the centre of it is a very small thick-walled shell about .25 m.m. in diameter. Occurs on White Oak (*Quercus alba*). Not common.

Pointed Bullet Gall on Oak (Holcaspis duricaria).

A spherical ball-like gall produced upon the stem of White Oak and Burr Oak. A short point at the apex of the gall distinguishes this species from *globulus*. Hard and woody, with a small cavity in the centre, containing a small, oval monothalamous, thin-walled, larval chamber. Occurs on Burr Oak (*Quercus macrocarpa*). Common.

Little Oak Apple (Andricus palustris).

This gall is produced by a malformation of the leaf blade, nearly always at the outer edge. It is a spherical, monothalamous, hollow ball, projecting from both sides of the leaf. It is from .9-1 cm. in diameter and comparatively thin-walled. The interior cavity is lined with smooth tissue and contains only a small thin-walled ball which rolls about freely in the gall. The single chamber of this ball contains a small larva. This ball is about 2 m.m. in diameter. The insect emerges, through a small hole cut in the side of it, in May. The gall is green or green and red. Occurs upon the leaves of Pin Oak (*Quercus palustris*). Not common.

Oak Midrib Gall (Andricus piger).

This gall is an irregular, woody swelling of the midrib of Burr Oak. It averages about 7/8 inches in length, and about 5/8 inches in diameter. Externally it is green, glabrous or slightly pubescent and projecting on both sides of the leaf. Internally it is dense and somewhat woody in structure, and containing numerous small cells about .5 m.m. in diameter, surrounding each of which is a layer of harder tissue. These are the larval cells. The gall-flies escape early in June through holes cut through the gall. Occurs upon leaves of Burr Oak (*Quercus macrocarpa*). Common.

Furry Ball Gall on Oak (Andricus lana).

This gall is produced upon the midrib upon the under side of the leaf of the Burr Oak. It is a white, furry, hemispherical mass, varying from 4-11 m.m. in diameter. This is composed of innumerable fine, woody fibres to which are attached small round kernels, in each of which is a minute white larva. These kernels are attached to the midrib of the leaf. Occurs upon leaves of Burr Oak (*Quercus macrocarpa*). Not common.

Willow Apple Gall (Pontania pomum).

A smooth, fleshy, sessile, globular or slightly oval monothalamous gall, like a miniature apple. About 1 c.m. in diameter, growing on one side of the midrib of the leaf and extending to its edge or beyond it. The principal part of the gall projects from the underside of the leaf. Color greenish yellow, often with a rosy cheek. Mature about July 31st. Occurs on many species of scrub willows (*Salix sp.*) Common.

Flat Galls on Willow (Pontania hyalina).

Fleshy galls, occurring in two parallel rows, one on either side of the midrib, sometimes touching, but not originating from the latter and rarely extending to the edge of the leaf. Sometimes as many as twenty to a leaf. In other cases confined to a row on one side of the leaf, or occasionally occurring singly. Shape irregular, elongate-ovate, projecting equally in both surfaces of the leaf. Color on upper side more or less brownish red, beneath white with slight purplish tinge. "Eggs and larva are subject to attack of mites, thrips, a curculionid (Anthonomus sycophanta) and a lepidopterous larva which eats out the entire interior of the gall tenthredinid larva and all." (From Marlatt. "Revision of Nematinae.") Occurs on many species of scrub willow (*Salix sp.*). Very common.

Pithy Blackberry Gall (Diastrophus nebulosus).

A large, oblong, polythalamous stem gall, 1 to 3 inches in length, and 1 to 1½ inches in thickness. The surface is uneven with deep longitudinal furrows, which divide the gall more or less completely into four or five portions. Occurs on Blackberry (*Rubus sp.*).

Lettuce Tumor Gall (Aulax timidus).

It occurs on the stem of Wild Lettuce. It is an irregular, oval, polythalamous, knotty enlargement of the stem varying greatly in size. The interior is soft and pithy. Occurs on Wild Lettuce (*Lactuca Canadensis*). Not common.

Oak Button Gall (Neuroterus umbilicatus).

This gall appears as a small button-like enlargement on the upper and lower surfaces of the leaves of the Oaks. Occurs on Burr Oak (*Quercus macrocarpa*). Not common.

Oak Bullet Gall (Holcaspis globulus).

It is found on the twigs of many species of Oak. It is a smooth, round, monothalamous gall. The interior is corky, with a small lighter coloured oval cavity in the centre, containing the larva. It grows singly or in clusters of two or three. Occurs on Burr Oak (*Quercus macrocarpa*), and White Oak (*Quercus alba*). Common.

Oak Pea Gall (Cynips pisum).

This is a spherical dithalamous gall, resembling a small pea. The surface is fissured or netted with depressions between which are elevations. It resembles a small pea. Occurs on White Oak (*Quercus alba*) and Burr Oak (*macrocarpa*). Not common.

Barley Jointworm (Isosoma hordei).

A small gall forming a woody growth which fills up the cavity of the stalk and causes the joints to swell, and the stalk to topple over. The larva remains in the straw over winter, and the adults emerge in the spring.

Huckleberry Gall (Solenógopheria vacinii).

Rounded or elongated galls 1-2 c.m. in diameter on the stem of the huckleberry. They are green or red in summer, and brown, hard and woody in winter. Occurs on Huckleberry (*Gaylussacia resinosa*). Common.

HEMIPTERA.

By Rev. Thomas W. Fyles, D.C.L., F.L.S., Levis, P.Q.

Bugs! "Disgusting!" says the fair reader who may chance upon this article; and truly I agree with her. I have no word bad enough for "the terror that walketh in the darkness"—the old, original "bug-a-boo."

I shall never forget a night I spent on board a small river-steamboat. The vessel left its wharf very early in the morning, and a friend (?) persuaded me to take a berth on board. What a night I spent. No sooner were the lights put out, than I began to experience a creepy sensation that effectually "murdered sleep." (Fig. 18.)

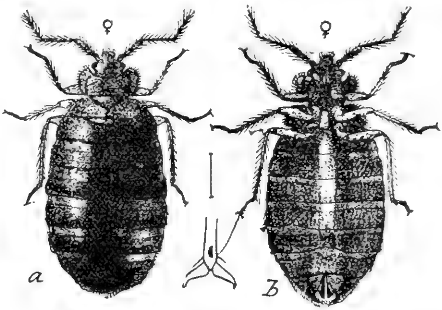


Fig. 18.—Female Bed-bug, much enlarged, a, upper, and b, under surface (after Marlatt.)

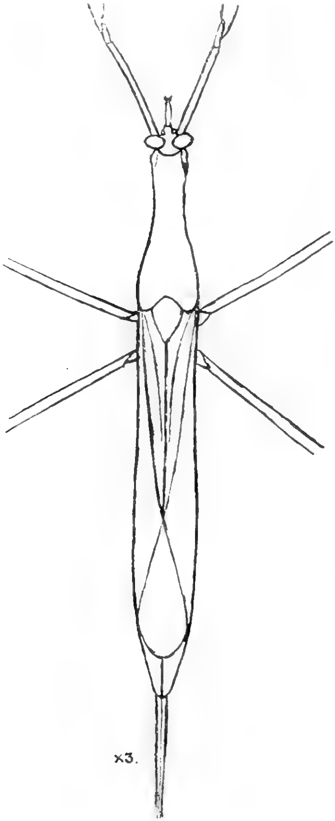
Confined in a small crib, and having no light, my case was worse than that of a certain church dignitary and his chaplain who, when on a visitation tour, sought shelter in a cottage, late one night. They were welcomed gladly; and the only spare-bedroom was placed at their service. On retiring the great man turned down the bed-clothes, but quickly turned them back again, for there were things in possession of the bed. He thought discretion the better part of valour, took his valise for a pillow, wrapt his long cloak around him, and stretched himself upon the floor. There he soon slept the sleep of the just. Meanwhile his companion, ensconsed in an armchair, amused himself by writing a parody on some well-known lines. One verse of his production read thus:—

> "No dirty blanket enclosed his breast;
> Nor in sheet, nor in quilt we wound him;
> But he lay like a clergyman taking his rest
> With his camlet cloak around him."

In my entomological investigations in the Province of Quebec, I have met with representatives of the undermentioned families of bugs:—

Corimelænidæ.
Pentatomidæ.
Coreidæ.
Lygæidæ.
Capsidæ.
Acanthiidæ.
Tingitidæ.
Aradidæ.
Phymatidæ.
Nabidæ.
Reduviidæ.
Hydrobatidæ.
Belostomatidæ.
Nepidæ.
Notonectidæ.
Corisidæ.

I shall not attempt to give an orderly and systematic account of the various species, belonging to these families, that have come in my way. The space at my disposel in the report will not admit of this. I shall tell, in a desultory way, of some of the more remarkable and interesting of the species, mentioning the family to which each of them belongs.



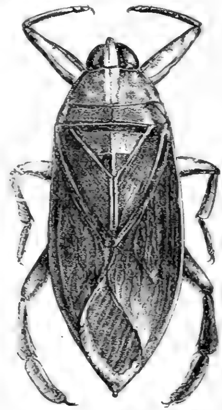


FIG. 19.—Giant Water-bug.

FIG. 21.—A typical Bug.

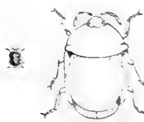


FIG. 20.—Ranatra quadridentata (greatly enlarged).

FIG. 22.—Corimelæna atra

First then, the Giant of the Bugs, far beyond all others of our bugs in size and strength, is *Belostoma Americanum*, Leidy, (Fig. 19), belonging to the *Belostomatidæ*. This creature attains a length of nearly two and a half inches, and an expanse of wings of four inches. Its hindmost pair of legs are an inch and three-quarters long, and are used for propelling it through the water. The colour of the insect is dark brown. In the breeding season it occasionally leaves the water; and it is capable of long flights. Its wings are true bug-wings, having the upper part horny, and the lower

part membranous. Its eyes protrude and resemble shining black beads. It has a stout proboscis for piercing its prey, which consists of fishes, tadpoles, etc. Its long stout front legs terminated with sharp claws enable it to grasp its victims firmly.

Another remarkable water-bug is *Notonécta undulata*, Say, belonging to the *Notonectidæ*. This insect is boat-shaped, but the keel is along its back; so it swims with its back downwards—its long legs bending over its sides, and serving as oars. In its movements it reminds one of a boy swimming on his back.

A still more noteworthy insect is *Ranatra quadridentata* (Fig. 20), belonging to the *Nepidæ*. Length is the characteristic of this insect. It has a long slim body, long thin legs, long antennæ, and long terminal respiratory tubes; its front legs are constructed for grasping its prey. It frequents shallow streams, *walking on the bottom*, and lifting the tips of its breathing tubes to the surface for air.

But, if it is wonderful to see a winged insect walking at the bottom of the water, it seems all but miraculous to behold one walking with ease and swiftness on the top. Yet this is the habit of *Hygrotrechus remigis*, Say, and also of *Limnoporus rufoscutellatus*, Fab., both of which are common with us. The former is black; the latter, pale reddish brown. Both belong to the *Hydrobatidæ*.

Of bugs that frequent plants, the Negro Bug (Fig. 22), *Corimelæna atra*, Am. et Serv., in the *Corimelænidæ*, is particularly obnoxious. It lays its eggs on small fruits, raspberries, etc. Should a person, by mischance, put a berry that has been visited by the bug into his mouth, a most nauseating taste and smell will quickly cause him to eject it. The bug is a pretty, compact little insect, of a shining black, and almost as broad as it is long. It is often seen on wild strawberry plants; and, when disturbed, it scuttles away to the underside of a leaf.

An insect of economic importance is found in the *Pentatomidæ*. I refer to *Stiretrus fimbriata*, Say. It preys upon the Potato Beetle, *Doryphora decem-lineata*, Say. Unfortunately, it shares the fate of the beetle and is poisoned by Paris Green. *S. fimbriata* is really a handsome insect. Its dark brown wings and deep red thorax outlined with crome-yellow; and it has a peculiar mark, in the middle of the back, of the same colour, and, in shape, resembling an elongated horse-shoe.

Another useful bug is *Podisus placidus*, Uhler (Fig. 23), belonging to the same family as the foregoing. It preys upon the Imported Currant-worm, *Nematus ventricosus*, Klug., and other larvæ. A description of this bug will be found on page 342 of Saunders' "Insects Injurious to Fruits."

In the same genus comes *Podisus cynicus*, Say, a fine bug seven-twelfths of an inch long, and four-twelfths wide. It is of a reddish-brown colour, slightly mottled with black.

A very pretty little bug in this family is *Cosmopepla carnifex*, Fab. It is black, bordered with red, and crossed on the thorax with red. It has also two red spots on the back.

Another fine insect in the same family is *Euschistus fissilis*, Uhl. It is half an inch long and one-third of an inch wide. In colour it is ochreous or pale brown, and it is thickly covered with minute black dots.

A somewhat smaller insect is *Euschistus tristigma*, Say. Its body colour is darker than the preceding; and the flattened edges of the abdomen are marked with alternate black and orange patches. The wings of this species are splendidly iridescent.

A third insect that comes, I think, in the same family is *Homœmus æenifrons*, Say. It is reddish-brown in colour, clouded with darker brown; and it has a peculiar mark, like an elongated cone rising from the end of the abdomen towards the middle of the back. These creatures frequent the heads of grass.

Acanthosoma cruciata, Say, is an interesting species in the *Pentatomidæ*. In colour it is ochreous with brown markings, and it has the appearance of having been oiled and varnished. Its back is marked with a floriated cross. When the wings are spread the abdomen on the upper surface is seen to be tinged with vermillion.

But the finest of our species of *Pentatomidæ* is undoubtedly *Pentatoma ligata*, Say. It may readily be known. It is a robust insect, of a rich Brunswick green, bordered with orange red; and it has an orange spot on its back. The insect is somewhat rare at Quebec.

In the family *Coreidæ*, to which the common Squash-bug, *Anasa tristis*, De G., belongs, we have *Alydus eurinus*, Say—a dingy insect, long and narrow with lighter coloured wings.

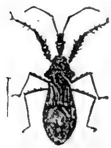


FIG. 24.—Assassin Bug.

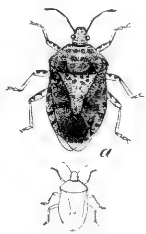


FIG. 23.—Podisus placidus.

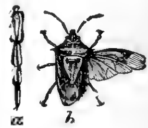


FIG. 25.—Acholla spinosa.

In the *Lygæidæ* we have the pretty bug *Lygæus turcicus*, Fabr. This insect is a long oval in shape, black, with a red band across the shoulders, and a red St. Andrew's Cross upon the back. The underside of the abdomen is lurid red.

Among the bugs injurious to plants may be reckoned *Pecilocapsus lineatus*, Fab., (4-vittatus, Say), a pretty yellow bug, with black lines on the wings, and two very conspicuous black spots on the thorax. These insects do injury to the leaves of currant bushes and garden plants; and they also taint the small fruits. They and the next mentioned insect belong to the *Capsidæ*.

Capsus lineolaris, Beauv., the Tarnished Plant-bug is ochreous with fuscous shades. It has dark spots along the edge of the abdomen. These insects damage the leaves of pear trees, apple trees, etc.

The *Tingitidæ* are a remarkable family of bugs. The species are very small and very elegant. Seen under a microscope, they appear to be covered with lace-work. On account of this, they have been called "Lace Bugs." The common species is *Corythuca arcuata*, Say. I have found a beautiful species on the Island of Orleans that I have not yet identified. The insects are found on the underside of Alder leaves.

The "Flat Bugs" or *Aradidæ* are found under bark, and in crevices of trees. They are predaceous. In vol. XXXV. of the *Canadian Entomologist*, I have given a full description of a new species that I have taken at Quebec, and have named *Aradus luteolus*.

A bug of remarkable shape is *Coriscus subcoleoptratus*, Kirby, in the family *Nabidæ*. It has the head and thorax narrow, and the abdomen greatly widened in proportion to the size of the insect. It is suggestive of a flask. Its body colour is black, but the abdomen has a yellow border. The legs and long sharp proboscis are yellow. Its wings are very diminutive.

In the late summer when our country road sides are adorned with the Golden Rod, the pretty little Fritillary, *Argynnis Myrina*, Cram., may be seen in numbers sporting about the flower heads. Here and there one of these butterflies may be seen motionless—lifeless If one will take the trouble to look into a case of the kind, he will probably find that the ill-starred insect has fallen into the clutches of a lurking foe, *Phymata erosa*. Fabr., belonging to the *Phymatidæ*. This strange insect is yellow beneath, and yellow marked with brown above. It has yellow legs and proboscis, and angulated thorax and abdomen. It lies back downwards among the blossoms of the Solidago, patiently awaiting its prey. A butterfly alights with outspread limbs. One of these comes within reach of the expectant bug. Instantly the extended tarsus of the bug springs back over the leg of the butterfly, and into a toothed groove in the disproportionately large tibia of the bug; and the victim is held securely, while its foe thrusts its long proboscis into its body and drains away its life juices.

I will mention only two other species—they are known as "Assassin Bugs," (Fig. 24) for they make other insects their prey. They belong to the *Reduviidæ*, to which the "Kissing Bug" of ill-repute, *Melanolestes picipes*, H.S., also belongs.

Acholla multispinosa, De G. (Fig. 25), is a brown insect, two-thirds of an inch long. It has a forbidding appearance, which is well, for it is a dangerous creature. On pages 73-5 of the Thirtieth Annual Report of the Entomological Society of Ontario, Dr. Bethune has given a well-authenticated account of the death of a child from a puncture from the proboscis of a bug of this species. The child was wounded under the knee, and blood poisoning ensued.

The other species is *Opsicœtus personatus*, Linn. It is a larger insect than the last mentioned, being three-fourths of an inch long; and— with the exception of the under wings—it is wholly black, or very dark brown. When its wings are outspread, its abdomen is found to be hollowed out, like a scoop or spoon. This species enters houses in search of *Acanthia lectularia*, Linn. Its larva has the habit of covering itself with a coat of dust or mud, and, so disguised, escapes notice till its motions betray its presence.

I do not think the *Reduviidæ* go out of their way to inflict injury upon human beings. I think it may be said of them that, *unmolested*, they do not molest.

The late highly esteemed J. Alston Moffat once told that he had held a specimen of *A. multispinosa* firmly between his finger and thumb, while he searched for a pin wherewith to transfix it. The bug managed to get its head free, and then, *sent in its little bill for damages*, greatly to Mr. Moffat's discomposure.

Disagreeable as many species of the Hemiptera undoubtedly are, they yet serve valuable purposes in keeping down the numbers of other and injurious insects; and the habits of some of them are so remarkable as to claim more than a passing notice. In dealing with them the poet Cowper's rule is worthy of attention—*of course entomologists are exempt from it!* He says:—

"The creeping vermin, loathsome to the sight,
And charged perhaps with venom, that intrudes,
A visitor unwelcome, into scenes
Sacred to neatness and repose, th' alcove,
The chamber, or refectory, may die:
A necessary act incurs no blame.
Not so when, held within their proper bounds,
And guileless of offence, they range the air,
Or take their pastime in the spacious field;
There they are privileged: and he who hunts,
Or harms them there, is guilty of a wrong,
Disturbs th' economy of Nature's realm,
Who, when she formed, designed them an abode,
The sum is this. If man's convenience, health,
Or safety, interfere, his rights and claims
Are paramount, and must extinguish theirs
Else they are all—the meanest things that are—
As free to live, and to enjoy that life,
As God was free to form them at the first,
Who in His sov'reign wisdom made them all."

The Task—Line 568 to line 587.

BASSWOOD, OR LINDEN, INSECTS.

BY ARTHUR GIBSON, EXPERIMENTAL FARM, OTTAWA.

The following notes on insects found feeding on basswood, *Tilia Americana*, are chiefly from records handed to the writer since the publication of a paper on the above subject which appeared in the 34th Annual Report of this Society, and of a further paper in the 35th Annual Report. In the first paper 94 species are listed, and in the 1904 Report further notes on some of these insects are given, as well as notes on 8 other species, which brought the list up to 102.

ATTACKING THE FOLIAGE.

ORDER HOMOPTERA.

Mr. W. Metcalfe, of Ottawa, who has devoted considerable time to the collection and study of homoptera and hemiptera, has been good enough to give me 15 records, which I am glad to include here. All of the species found by him were on basswood.

103. The common "Buffalo-tree hopper," *Ceresa bubalus*, Fabr. Five specimens of a dark form taken, Ottawa, July 14, (Metcalfe).

104. *Telamona reclivata*, Fitch, Ottawa, July 1, (Metcalfe). Mr. Metcalfe tells me that he has taken later in July five specimens, all on basswood, of a species of *Telamona*, which does not seem to be *reclivata*.

105. *Ormenis pruinosa*, Say. Mr. Otto H. Swezey, in his "Preliminary Catalogue of the Described Species of the Family Fulgoridæ, of North America, North of Mexico" (Ohio Dept. Agric., Div. Nursery and Orchard Inspection, Bull. 3) mentions basswood among a great many other food plants of this homopterous insect. The insect is rare in Ontario.

106. *Lamenia vulgaris*, Fitch. Ottawa, July 1, (Metcalfe).

107. *Bythoscopus variabilis*, Fitch, var. Ottawa, June 19 to 24, (Metcalfe). This insect is a near relative to the very injurious grape vine leafhopper which is so abundant some seasons in Ontario.

108. *Agallia novella*, Say. Ottawa, June 24, (Metcalfe).

109. *Diedrocephala coccinea*, Forst. Ottawa, bred from basswood, maple and hickory, (Metcalfe).

110. *Deltocephalus Sayi*, Fitch. Hull, Que., July 1, (Metcalfe).

111. *Empoasca flavescens*, var. *Birdii*. Ottawa, Aug. 14, (Metcalfe).

112. *Empoasca mali*, LeB. Hull, Que., June 24; Britannia-on-the-Bay, Ont., Aug. 7, (Metcalfe). This insect, which is known as the apple-leaf hopper, is, according to Smith, "seriously troublesome in some years" in New Jersey, but it is not a pest of any importance in Canada.

113. *Typhlocyba rosæ*, L., the common rose-leaf hopper. Ottawa, July 1, (Metcalfe).

114. *Typhlocyba querci*, Fitch, var. *bifasciata*, G. and B. Hull, Que., June 24; Britannia-on-the-Bay, Ont., Aug. 7, only found on basswood, (Metcalfe).

Order Hemiptera.

115. *Lygus invitis*, Say. Hull, Que.; Ottawa; August, 60 specimens, (Metcalfe). This insect belongs to the same genus as the common well known pest of garden plants, the Tarnished Plant bug, which is very abundant in many parts of Canada.

116. *Gargaphia tiliæ*. Walsh, Ottawa, taken only on basswood, August, (Metcalfe). In Smith's List of New Jersey Insects, it is stated that this insect "ranges from New York to Virginia."

117. *Tingis arcuata*, Say. Hull, Que., July 1, (Metcalfe). In Packard's Forest Insects the species is mentioned as having been found on the under sides of the leaves of the White Oak.

118. *Coriscus inscriptus*, Kirby. Ottawa, June 19, (Metcalfe). Smith states that this insect "occurs from Canada to Virginia and California."

Order Lepidoptera.

19 of 1903 List. *Ennomos alniaria*, L. Although the larva of this common moth has been recorded on several occasions by other writers as feeding on basswood, it was not until the past season that the caterpillar was found on that plant in the Ottawa district. At Meach Lake, Mr. C. H. Young collected a larva which pupated on Sept. 10.

119. *Smerinthus jamaicensis*, Drury. In the preparation of my first list of basswood insects, I omitted to include this species, the larva of which feeds on a variety of plants, such as elm, apple, plum, willow, poplar, ash, birch, basswood, etc. In Lugger's Fourth Annual Minnesota Report, plate XV., there is a good figure of the mature larva. In Canada, the species is widespread, occurring as far west as Medicine Hat, Assa., from which place, in 1900, eggs were sent to the Division of Entomology, by Mr. T. N. Willing. The eggs hatched on June 5, and notes were taken on the larval stages. The larvae were fed on willow and poplar.

120. *Mineola indigenella*, Zell. var. *nebulella*, Riley? In 1904 we reared from apple some specimens of a small moth which seems indistinguishable from this apple feeding species. The habits and appearance of our larvae, however, are different from those of *indiginella* as published by Riley and Saunders, and Dr. Fletcher thinks that it cannot be the same. On Sept. 20, 1905, the writer found on basswood three of the larvae, all on the upper side of the leaf. In each case the larva was resting under a slender tent of silk, which was about half an inch in width and nearly an inch in length. The three leaves were all put in the same breeding jar, but two days after collection I was surprised to see only one larva in the jar. On looking closely, however, I found portions of each of the other two, and there was no doubt

that a serious tragedy had taken place. The remaining specimen spun a cocoon in a fold of a leaf on Sept. 23. When mature the caterpillar is five-eighths of an inch long, body pale green, the black noticeably washed with yellow. Head rounded, green, marked with numerous small reddish-brown dots and large blotch-like spots, the small dots being particularly on upper portion of head. On each side of the body there is a dark brown stripe, broken in places, and touching these two stripes crossing the back is a series of conspicuous wide bands of the same colour. These and the side stripes have a very ladder-like appearance. The spiracles are black and very small, as are also the tubercles. From each of the latter there is a single pale hair. The feet are concolorous with the ventral surface of the body.

61 of 1903 List. *Apatela morula*, Grt. On several occasions recently the larva of this noctuid has been beaten from the foliage of basswood at Ottawa. The writer found the caterpillar on July 30 last, and Mr. C. H. Young collected mature specimens on Sept. 2 and 5. Other food plants are elm and apple. When full grown the larva is about two inches in length and is of a light olive grey colour. The head is black, and down the centre of the dorsum there is a wide, uneven, dark gray band, yellowish centrally. On body segments 4, 7 and 11 there is a conspicuous dorsal enlargement, which is bordered on the sides with black. Along the sides of the body are a series of V-shaped blackish marks, with the round black spiracle at the base. The hairs from the tubercles on the body are thin, whitish and rather inconspicuous. In March, 1901, Mr. Young found the cocoon of this moth under the bark of an elm tree, about four feet from the ground, and since that date in confinement, he tells me that two larvae entered soft dead wood to the depth of fully an inch and there pupated.

OCCURRING ON THE BARK.

Order Homoptera.

121. *Eulecanium cerasifex*, Fitch. On July 18, I collected some scales on basswood and elm. These were on the lower branches of some old trees growing near the Arboretum of the Central Experimental Farm. Through the courtesy of Dr. Howard, they were identified as the above species by Mr. Sanders. The scales were fairly abundant on both kinds of trees. In Mrs. Fernald's Catalogue of the Coccidæ of the World, the following food plants are given:—cherry, plum, peach, apple, pear, maple, oak, ash.

BORING INTO THE WOOD.

Order Coleoptera.

122. The Cherry Flat-headed Borer, *Dicerca divaricatu*, Say. Specimens of this insect were found in basswood on July 9 last by Mr. Frank Morris, of Port Hope, Ont., on the shore of Rideau Lake, near the Narrows Locks, Ontario. This insect, which is well known as being destructive to cherry and peach trees, is common in Ontario, and always injuriously abundant on maple and beech, as also sometimes on pine, birch, hickory and other trees. The mature insect is a brownish, or blackish bronzy beetle, of rather stout build, from three-quarters to almost an inch long.

84 of 1903 List. *Parandra brunnea*, Fabr. From the same wood as the specimens of *Dicerca divaricata*, Say, were taken. Mr. Morris also collected 30 specimens of *P. brunnea*, Fabr. This insect, while it is sometimes found in numbers as occurred at Rideau Lake in July last, is an uncommon species. It is widespread in distribution. The grubs live in the wood of stumps and old trunks of various deciduous and coniferous trees, the beetles being found under the loose bark.

INSECTS INJURIOUS TO ONTARIO CROPS IN 1906.

By Dr. James Fletcher, Dominion Entomologist, Ottawa.

The weather conditions in Ontario during 1906 were very variable. In eastern Ontario the summer was exceptionally dry with two or three periods of excessive heat. The precipitation, however, for the whole province notwithstanding the shortage in the east was slightly above the average, and in western Ontario for the month of October was abnormally large. Crops were on the whole good in nearly all districts, both in quality and quantity.

Grain Crops were little injured by insects. Spring wheat was particularly free from insect attacks of all kinds and little was heard of rust. Fall wheat was decidedly above the average, and the Hessian Fly seems almost to have disappeared. Not a single report of Joint-worm in Ontario crops was received. Barley was one of the best crops which has been harvested for many years. Oats in the western counties were heavy, and there was some difficulty in harvesting, owing to the crop being lodged by rain storms. In the eastern counties, the quality was high for the most part, although a few crops were light for lack of timely rains. Grasshoppers in a few localities reduced the yield by cutting off the grains just before ripening. Peas were a good crop and the Pea Weevil was hardly mentioned. The area being sown to this important crop is again gradually increasing. The corn crop throughout the province was exceptionally good, both for the silo and for grain.

Roots in the western counties were good, but in the east were rather small and dry for lack of fall rains. There was very little injury this year to turnips by the Turnip Aphis, the only reports of serious injury coming from the counties of Victoria, Durham and Northumberland. Potatoes in the east were small but of high quality. There was little complaint of loss from Potato Rot, largely due to the fact that farmers are spraying much more systematically than hitherto to control this destructive disease. The standard remedy,Poisoned Bordeaux mixture, made with six pounds of copper sulphate, four pounds of unslaked lime, and eight ounces of Paris green in 40 gallons of water, has given very satisfactory results wherever tried. The experiments carried on at Ottawa regularly every year by the Horticulturist of the Central Experimental Farm have proved conclusively that three sprayings of the fields, the first one being applied in the middle of July, and the subsequent ones two weeks apart afterwards, give very paying returns. A fourth spraying gives better results, but it seems difficult to get farmers to make this extra application. Cutworms, although little complained of, were abundant and destructive in some places. Wherever tried, the poisoned bran remedy surprised those who used it with its effectiveness. Even in an exceptional and widespread outbreak in the grain and sugar beet fields of the West, this same remedy proved so remarkably successful, that many letters were written to newspapers and agricultural journals, giving the results of trials by those who had benefited from it.

Fodder Crops. Clover was attacked to some extent by the Clover-seed Midge, but on the whole, the crop of seed was above the average for quality. In the eastern counties, clover fields were remarkably thinned, owing to the mild winter with little snow, which was very severe on all meadows. The Black Army-worm, *Noctua fennica*, and the Clover Cutworm, both levied heavy toll on the very much reduced stand of clover. Rape, which is now being much more grown than formerly, was severely injured in several places by the caterpillars of the Small White Cabbage Butterfly, which appeared in vast numbers during the months of September and October.

An interesting observation was made on the Experimental Farm, where a field of late turnips was practically cleared of swarms of these caterpillars by the English Sparrow. The observation was made by Mr. B. Nothnagel, who watched them for several days, and by driving the birds away suddenly, induced them to drop their prey so that he might examine it. It is pleasing to have a good word to say for these very troublesome and destructive birds.

VEGETABLES. Carrots in gardens were attacked in a few places in the Ottawa district by the Carrot Maggot, or Carrot Rust Fly. This injury was not widespread nor quite so severe as in 1905. The remedies which gave the best results, were spraying the rows of plants immediately after they were thinned out, with a carbolic acid and soap wash, or with kerosene emulsion. Dusting the plants with hellebore was also apparently effective, but even in untreated beds, the insect disappeared about the beginning of July, and late sown carrots were entirely free of attack. The Onion and Cabbage maggots were conspicuously less destructive in many parts of the province than has been the case for some years This report, however, was not applicable in all parts, as was evidenced by the large numbers of enquiries for a practical remedy. Such, however, it must still be acknowledged has not so far been discovered. Good results on small areas were secured by dusting the plants from the beginning of the season once a week with a light dressing of powdered white hellebore, either pure or mixed with three times its weight of land plaster. A remedy which has often been recommended in newspapers is to brush away the soil from the bulbs as soon as these begin to form. In experimenting with this remedy, it was found rather difficult to apply in certain soils, but on the whole gave good results, particularly where the treatment was supplemented by dusting with the hellebore powder.

The Asparagus Beetle was a rather serious pest to the growers of this highly esteemed vegetable, and extended its eastern range in the province considerably during the past season. It was a troublesome pest as far east as Toronto, and specimens of the larvae were found by the writer during September on a small bed of asparagus on the Experimental Farm at Ottawa. The mature beetles were reared later, and the species proved to be *Crioceris asparagi*. The remedies which have given the best results are dusting the plants when the larvæ occur, with a mixture of freshly slaked lime and Paris green. This is more effective if it can be done when there is dew on the plants, or when they are wet either from rain or after being sprayed. Both the beetles and the larvæ may be beaten from the plants into nets or into open pans containing water with a little coal oil on the top. Poultry of all kinds when available are useful in eating the beetles when they first appear in spring.

Potatoes in gardens were seriously attacked and very much reduced in yield by the Potato Leaf Aphis, *Nectarophora solanifolii*, Ashm. This was in the east of the province, and the injury was much aggravated by the exceptional drought. The Colorado Potato Beetle was noticeably less injurious than usual in the early part of the season, but it made up for any early absence by the excessive abundance in autumn.

FRUIT CROPS. The apple crop of the province for 1906 may be described as rather short in quantity, but of excellent quality in the eastern counties. In western Ontario, the ravages of the Codling Moth were severe, and throughout the province more injury was done by the Plum Curculio to apples than in any previous year of which we have statistics. This, to some measure, may have been due to the poor plum crop, which was a character of the season, and which is accounted for in various ways by differ-

ent writers. Probably the factor of most importance was cold, windy weather at the time of blooming. Sweet cherries were much reduced by winter killing of the buds, and by the falling of the fruit after setting. Sour cherries gave an excellent crop free from insect injury. Small fruits were abundant with the exception of strawberries, which were very much winter killed in the eastern end of the province.

The Codling Moth was more complained of than for many years, and where spraying was not resorted to the loss was great. In western Ontario, apple growers are now recognizing that they must both spray and band their trees to prevent loss, and moreover that this work must be persisted in and carefully done year after year. Banding the trees alone is useless, unless the cocoons of the caterpillars which have resorted to them for spinning up are removed or crushed at short intervals. The bands should be put on from the middle of July, and examined at least once a week until no fresh cocoons can be found. The irregularity of development in the Codling Moth makes it sometimes difficult for fruit growers to understand the true nature of this insect. In the eastern part of the province there is normally only one brood of this insect, whereas, in the west, there are two. There are, however, always a few individuals of each brood which behave in an exceptional manner. Of a large number of caterpillars of the Codling Moth collected at Ottawa in July, 1905, a few emerged the same summer, and would in a state of nature have given a second brood of larvae. By far the larger proportion of the brood, however, behaved in the normal way, and went over the winter as larvæ. Just at the time of spinning up, there were three or four days of excessively hot weather, which may have been the cause of some of the caterpillars producing moths the first summer. Several of the moths emerged at the proper time the next spring; but a small proportion of the larvæ are actually still unchanged in their cocoons at the present time, (December 1906), and as they are healthy they will probably emerge next year, thus showing that of the same brood some emerged as moths within a few weeks of the time of spinning up, while others treated in exactly the same way could remain in the cocoon for very nearly two years. In coming to a decision as to the number of normal broods of an insect, a matter of great importance in devising remedies, it is therefore necessary to take a general view of the facts, and not come to conclusions from exceptional variations in habit.

The Plum Curculio was exceedingly destructive to apples in many parts of Ontario and Quebec provinces during the past summer. Some apples sent from a locality near Toronto contained three or four grubs to each apple. The apples were seen to be falling to an unusual extent towards the end of June, and were sent for examination as to the cause of this dropping. The grubs of the Plum Curculio leave the apples during the month of July, and change to pupæ in the ground, the beetles emerging a few weeks later in August and September, and passing the winter as beetles. Good results, as far as the insect is concerned, have been secured by ploughing up sod in infested orchards at the end of July or early in August. If there were any anxiety as to stimulating too late a growth of the trees by the practice, it might be offset to a large measure by sowing the land at once to a cover crop to absorb soil moisture, the object of the ploughing being to break up the cells in which the delicate and soft pupæ are contained, so that many of them might be crushed or injured by the operation or might be exposed to their bird and insect enemies. The remedy in Canada which has given the best results against the Plum Curculio, and which is decidedly the most economical of those usually recommended, is the

spraying of the trees with the Poisoned Bordeaux mixture in the same way that apple trees are sprayed for the Codling Moth and fungous diseases.

The San Jose Scale. There has recently been a renewal of interest in the subject of the San Jose Scale, which has been a little more noticed than for a year or two in districts lying beyond the main centres of infestation. As a matter of fact there is very little news to be given concerning the occurrence of this most injurious insect in Canada. It is satisfactory, however, that more attention should be paid to it by fruit growers. The standard lime and sulphur wash is quite effective, and if used, as has been advised, year after year, will keep trees clean enough to bear good crops, and if persisted in as a regular annual treatment, not only this insect but many others as well as fungous diseases of various sorts will be gradually exterminated or prevented from injuring the crop to a marked extent.

The Apple Maggot, *Rhagoletis pomonella*, Walsh. In 1896 the Apple Maggot, also known as the Railroad Worm from the brown marks made through the flesh of the infested apples by the maggots, was first noticed as an injurious insect in Canada. This was in Lennox County. Since that time very little injury has been noticed in the orchards where it was first observed, but during the past summer there are reports of rather widespread infestation throughout the adjoining County of Prince Edward. The injury is serious, as it renders the fruit unfit for the market without showing any very apparent marks on the outside. The injury is caused by slender white maggots about ¼ of an inch in length, which burrow in all directions through the flesh of the apple, feeding upon the pulp and leaving discoloured galleries. The white maggots are extremely difficult to see, but there may be several within a single fruit. The eggs are inserted beneath the skin of the apple by the females which are strikingly beautiful little black and white flies with banded bodies and golden eyes. These are about half the size of the ordinary housefly, and although they do not fly far are very active in their movements. There is only one brood in the year, but the flies emerge very irregularly and may appear at any time from midsummer until autumn. The young maggots become full grown in about six weeks, when they leave the apples and enter the soil for a short distance, where they turn to yellowish white smooth puparia. Apples which are infested for the most part fall to the ground, and the maggots remain in the fallen apples for a short time after they have fallen. Maggots from late laid eggs are often inside the fruit when it is picked. Consequently apples, which are apparently quite good at the time of packing, may in a short time become perfectly useless. All varieties of apples are liable to attack, but some much more so than others. As a general statement, early and sweet apples are most infested. It is possible that this serious enemy of the fruit grower may before long be one of the enemies which will require to be reckoned with every season. For many years it has been the cause of much loss in Vermont, Maine, and in parts of New York State. There have also recently been some rather serious outbreaks in Canada, in the provinces of Quebec and New Brunswick. It is satisfactory to know that the injury, even in the worst infested localities, fluctuates very considerably in intensity. The only practical remedy so far known is to destroy all infested fruit as soon as that fact is discernible. Windfalls should be gathered up carefully, and at short intervals during the summer, and should at once be fed to stock or destroyed in some other way. What is thought to be the most economical and effective way of doing this is to allow growing pigs to run in the orchard from July, when early apples which are particularly liable to attack begin to fall, and the animals should be kept in the orchard until all fruit is gathered. Sheep will eat apples if there is not too much grass on the

ground, but they are less useful for this purpose than pigs. Chickens and other poultry are likewise of service. The ground under apple trees in districts where the Apple Maggot is known to occur should be cultivated regularly. If no stock is available to which fallen fruit can be fed, it should be buried in a deep hole, and then covered up with two or three feet of earth. As the egg of the apple maggot is inserted into the flesh of the apple by the females with their sharp ovipositors, there is no spraying mixture which can be used against this insect.

FLOWERS. In flower gardens, one of the striking outbreaks of the year has been the abundance in many parts of Canada of the minute Moth-flies, or White Flies. Such specimens of these as have been examined seem to be the Greenhouse White Fly, *Aleyrodes vaporariorum*, and it is possible that they may have been introduced into gardens with fuchsias and other plants propagated in greenhouses, and owing to some climatic condition have this year increased out of doors to a much larger extent than is usual. Although extremely small, these minute fly-like sucking insects are very destructive. The larval and nymph forms bear a somewhat close resemblance to their near relatives the scale insects. Plants which were badly infested at Ottawa were cucumbers, tropæolums, fuchsias and lilac bushes, but many other kinds were also more or less attacked. White Flies are difficult to control, but may be kept in check by the constant spraying of infested plants with whale oil soap solution, or a diluted kerosene emulsion. In greenhouses probably fumigating with hydrocyanic acid gas is the best remedy. ,

SHADE TREES. Ornamental shrubs and shade trees were severely attacked early in the season over a large part of the province by enormous numbers of plant lice, of many species. Trees particularly infested were soft maples by a species of Woolly Aphis, which was found in large clusters beneath the leaves of the Silver Maple. *Acer dasycarpum*, and its numerous varieties. Another new attack of the Silver Maple of more than usual interest was the wholesale destruction of the seeds by the larvæ of the Nitidulid beetle *Epuræa rufa*. The seed was produced in large quantities this year, and was ripe by the middle of June. Towards the end of the month some sacks of the seed were collected for sowing. They had lain on the ground for a few days; but were apparently in good condition. During July, however, it was found that nearly every seed was infested by slender, dirty-white grubs about ¼ inch long, with a testaceous roughened dorsal patch across the middle of each segment. Every seed contained from 12 to 18 of these grubs, which had reduced the contents of the seed to a green meal-like powder. When fully-fed, the grubs left the seeds and pupated near the surface of the ground. In August, large numbers of the beetles emerged. In the soil were also found many of the small cocoons of a parasite which has not yet emerged. The beetles of the family to which *Epuræa rufa* belongs are for the most part scavengers in habit, living upon dead and decaying animal and vegetable substances, but in this instance sound seeds were attacked, and the species can evidently be a destructive enemy to one of our favourite shade trees.

Birches of all kinds were covered from top to bottom with myriads of plant lice, so that by the middle of July the leaves began to fall noticeably. Early in July the abundance of Lady-bird beetles was noticed, particularly of the common Two-spotted Lady-bird *Adalia bipunctata*, and by the end of the month these had increased so much that the infested birch trees were almost cleared and the leaves took on a strange dirty appearance from the enormous numbers of the pupæ of the Adalia, as many as 18 to 20 being found in many instances on a single leaf. The good work done by

these insects in clearing the trees of their enemies was, however, only rewarded by these themselves proving a prey to another of nature's factors in preserving the balance of life. A very small percentage of these pupæ gave forth the beetles; instead, most of the pupæ produced a swarm of minute hymenopterous parasites.

Elm trees were badly attacked by the Woolly Elm-leaf Aphis, which, during the month of June, curled up the leaves of the elms used as shade trees, and made sidewalks and seats, or even walking beneath the trees, most unpleasant, owing to the showers of honey-dew which constantly fell from the clusters of plant lice. The Elm Soft-scale, *Lecanium canadense*, was also abundant and destructive in many places. The White Cedar or American Arbor-vitæ was seriously disfigured by the attacks of two minute moths, *Argyresthia thuiella*, Packard, and in far less numbers *Recurvaria thujaella*, Kearf. The injuries to these trees were so severe throughout the Ottawa district, both on private grounds and in the woods, as to give a rusty sickly appearance to all of the white cedars by reason of the large number of tips of young twigs which had been killed by the caterpillars boring inside them in autumn and again in the following spring after reviving. The minute caterpillars lived singly in a small twig, and each one was able to destroy a surprisingly large amount of green growth. The beautiful little moths, silvery white with brown markings, were found flying in clouds around the trees during the latter half of June.

ENTOMOLOGICAL RECORD, 1906.

By Dr. James Fletcher, Dominion Entomologist, and Arthur Gibson, Ottawa.

Judging from reports which have come to hand in connection with the Entomological Record, there has apparently been rather less enthusiasm than heretofore among collectors of insects in Canada during the past season. The personality and energy of Mr. R. V. Harvey, of Vancouver, have been effective in stirring up an unusual interest in all orders of insects in our Pacific province; and, as Secretary of the British Columbia Entomological Society, he has issued three most interesting quarterly bulletins, in which are valuable records of captures and items of entomological news, which will be useful for reference by all who take up the study of British Columbian insects. We trust that these bulletins will be continued regularly, and that all the members of the Society will see the advantage of promptly and regularly communicating to the secretary items bearing upon the provincial insect fauna.

Reports as to the nature of the season in 1906 were of a very diverse nature and were evidently much affected by local conditions. As an instance of this, the writers found sugaring for moths remarkably unremunerative at the Experimental Farm, Ottawa, while two other collectors, Mr. J. W. Baldwin, at Britannia Bay, about six miles west, and Mr. C. H. Young, at Meach Lake, fifteen miles north, noted the abundance of night flying moths at sugar. The suggested local cause affecting the question at the Experimental Farm, was that there was a remarkable outbreak of aphides on almost all kinds of trees and shrubs in the early part of the season, by which all foliage was thickly coated with honey dew, which proved more attractive to the moths than the treacle put on the trees. However, as is always the case, steady collecting was rewarded with many treasures.

Mr. J. D. Evans, at Trenton, was remarkably successful in collecting microlepidoptera in a lantern trap made as described by Mr. W. D. Kearfott.

A large number of notes of captures have been received from various parts of the Dominion, but some of the writers do not quite seem to understand what the scope of this record is, from the point of view of the present compilers. Large and complete lists of insects taken in a given locality are not desired; but merely notes on such as are of rare occurrence there, or concerning which specialists may have given interesting information in their letters. The capture of an insect beyond its recorded range or at an unusual season are records of value.

We beg gratefully to acknowledge the greater care which has been shown by several correspondents in giving exact data when these were procurable, and we would now point out that it would help materially in the preparation of Notes of Captures if correspondents, when sending in records, would put opposite each record, the number of the insect in the recognized check list of the order. This has been done by a few and is of very great assistance in making up the Record.

As in the past, we have again to express the great obligation Canadian collectors are under to the leading specialists in many orders of insects. Particular mention must be made of Dr. L. O. Howard, Dr. H. G. Dyar, and Mr. D. W. Coquillett, of Washington; Dr. J. B. Smith, of New Brunswick, N.J.; Dr. H. Skinner, of Philadelphia; Mr. W. D. Kearfott, of Montclair, N.J.; Prof. Wickham, of Iowa City; Prof. Hine, of Columbus, O., and Mr. E. P. Van Duzee, of Buffalo. All of these gentlemen have contributed largely to the exact identification of our Canadian captures during the past year. We again point out the wisdom of the greatest liberality in providing these specialists with any specimens they may desire from Canada. It is only after many years of study and collecting that they have reached the positions they now hold, of being able in a short time to name the specimens submitted to them. If at any time it is indicated that specimens would be acceptable, every effort should be put forth to discharge, in part at least and as soon as possible, the heavy debt of gratitude under which so many of us lie for past favours in the identification of material which, but for the assistance so freely given, would be comparatively useless.

During 1906 there have been a few expeditions made in Canada for the purpose of collecting insects; meagre records only of these have been received, either as to the special objects for which they were made, or as to the material collected. The officers of the Geological Survey of Canada, who in the past have collected many scarce insects from the little known regions visited by them in connection with their official work, during the past year, for one reason or another did not bring back many insects. The only collection made was a small one by Mr. L. M. Lambe in British Columbia. This is to be regretted, although the difficulties of collecting and preserving such fragile specimens as insects are well understood, and of course such collections are beyond the limits of the regular work for which most of the officers of the Geological and Natural History Survey Department go to the field. Mr. Theodore Bryant made a valuable collection of lepidoptera when engaged with the International Boundary Survey of the Alaska Coast strip. His work took him along the Taku River and the Tallsaykway, a tributary of the Taku. Messrs. George White Fraser and Robert Smith of the same survey also made a small but interesting collection chiefly Coleoptera and Hymenoptera in the Skagway District of Northern British Columbia. Messrs. R. V. Harvey and R. S. Sherman, of Vancouver, made an interesting collecting trip over the Hope Mountains from Fort Hope on the Fraser River, to Princeton on the Similkameen, a distance of 65

miles, between July 10 and 28. Many interesting lepidoptera and diptera as well as insects in other orders were collected. An account of this expedition is given in the Quarterly Bulletin of the British Columbia Entomological Society for September, 1906. Dr. Harrison G. Dyar again visited British Columbia this year, but his chief work was done with relation to mosquitoes and their habits. Mr. E. B. Williamson, of Bluffton, Inda., collected in Northern Ontario between July 29 and August 6 and secured a large amount of material. The syrphid flies (14 species) are now in the hands of Prof. R. C. Osburn, of Columbia University; and the Odonata are being worked up by Mr. Williamson and Dr. E. M. Walker. Mr. C. H. Young, of Ottawa, spent the summer at Meach Lake, Que., in the Laurentian Mountains, where he collected assiduously and reared many specimens from larvæ. He was particularly successful in collecting microlepidoptera, and set up in his characteristically exquisite manner over 1,500 specimens, all of which may be described as perfect. Mr. G. A. Moore, of Montreal, made a large collection of hemiptera at Como, Que., a complete list of which will appear at an early date in the *Canadian Entomologist*. In the present record, notes will be found of a few other insects taken by Mr. Moore at the same time. The Montreal collectors have had regular meetings and excursions, and, in addition to the work of the Montreal Branch of the Entomological Society of Ontario, the recently organized Mount Royal Entomological Club has done good work and has published a small pamphlet, Nos. 1 and 2, of proceedings. The Ottawa entomologists have continued to work energetically in connection with the Ottawa Field-Naturalists' Club, making many expeditions. A record of their work will be found in the *Ottawa Naturalist*, which is published regularly by that club. Messrs. T. D. Jarvis and E. J. Zavitz, working with the Rev. Prof. Bethune at the Ontario Agricultural College, have created much interest in entomology among the students. Mr. Jarvis has specialized on galls and gall insects and has accumulated a large collection. Mr. Zavitz has directed his attention chiefly to forest insects, and both will be pleased to hear from correspondents in all parts of Canada concerning these important branches of entomology. In Nova Scotia excellent work has been done by Mr. John Russell, of Digby, N.S., who has added many species to those already recorded from the Maritime Provinces. Mr. Joseph Perrin, of Halifax, has also added to his previous laurels by collecting many rare species. Among those whose names are well known for the work they have done in connection with Canadian entomology, vigorous work has been continued during the past season in their various localities, by the Rev. G. W. Taylor, of Wellington, B.C., who continues his studies of the geometridæ, and who, although absent for the greater part of the summer on the Dominion Fishery Commission, has found time to name many collections which have been sent to him for identification. Mr. J. W. Cockle at Kaslo has added largely to his collection of Kootenai insects, and Mr. A. H. Bush, of Vancouver, has collected throughout the season and added several new names to the local list. In the foothills of the Rockies, Messrs. Thomas Baird, of High River, F. H. Wolley-Dod and F. A. Hudson, of Millarville, have done good work in unravelling difficulties connected with their interesting western fauna. In the Okanagan Valley Mr. E. P. Venables has made useful observations, in the prosecution of which he is now aided by his friend Mr. E. S. Wilmot, who has already taken some rare species, not previously recorded from the district. Mr. T. N. Willing has collected energetically in many parts of Saskatchewan and has accumulated much material in all orders. These are being worked up and will form a nucleus for a reference museum in connection with the Provincial Department of Agriculture, which will be of inestimable value

to farmers and others. In Manitoba Messrs. Criddle, Heath and Marmont have continued their work enthusiastically and have added very much to our knowledge of the insects of that province.

Literature.

Among the many valuable works, reports and separate papers of interest to Canadian students of insects, which have been received during the past year, special mention may be made of the following:—

Cary, Merritt. The Diurnal Lepidoptera of the Athabasca and McKenzie Region. (Proc. U. S. N. M., Vol. XXXI, pp. 425-457). This paper will be of special value to our western members. It gives as complete a list as can as yet be compiled. The facts are taken from published lists and also from the collections of the author while making a biological exploration in the north during the summer of 1903, and of Mr. E. A. Preble in 1903 and 1904. Other species will doubtless be added to this list, but it is an excellent starting point for future work. Great care has evidently been taken to give full credit to all who have done anything, however little, in working up the diurnals of this little known region.

Casey, Thos. L. Observations on the Staphylinid Groups, *Aleocharinæ* and *Xantholinini*, chiefly of America. (Trans. Academy of Sciences of St. Louis, pp. 125 to 434.) Coleopterists will note with great pleasure that Major Casey is again at work in the Staphylinidæ, a group of insects in which he has done such magnificent work. The present monograph covering particularly the two extremely difficult sub-families mentioned, will give a stimulus to North American collectors who have required just such a revision as is now provided to work up their material.

Felt, E. P. Insects Affecting Park and Woodland Trees. (Memoir VIII, N. Y. State Museum; 4to, Albany, 1905, pp. 332, plates 48, 20 coloured.) This sumptuous volume is printed on the best of paper, and everything is carried out as well as can be done by skilful printers and binders, a fit setting for the care and skill devoted to its preparation by Dr. Felt and his assistants. It brings together the results of many years' work and is supplementary to Dr. Packard's Forest and Shade-tree Insects. The letter-press is well prepared so as to be of the greatest use to the large number who will consult this work, but who are not trained entomologists. The entomologist, however, will also find that much care has been exercised in the identification of all species mentioned and in working up accurately the life-histories presented. The plates are of unusual beauty; Dr. Felt seems to have the same ideal as actuated Sir Edwin Landseer, who never portrayed in his pictures any animal that was not a thoroughbred or which was not in the best of condition. Dr. Felt's insects, even when reproduced by photography, are not only perfect, but have been set and prepared for reproduction with the greatest care. Some of the plates illustrating moths are probably unsurpassable in this respect.

Fernald, Henry T. The Digger Wasps of North America and the West Indies belonging to the sub-family Chloroninæ. (Proc. U. S. N. M., Vol. XXXI, pp. 291-423, 5 plates.) Dr. Fernald has brought a well-trained mind to bear upon the difficult task which he set himself and has done his work in such a way as to deserve the thanks of all hymenopterists. All the extensive collections in the United States have been examined, and all types so far as known have been studied. It is to be hoped that more students will devote themselves to these interesting insects now that this further help has been added to existing literature.

FOLSOM, J. W. Entomology with Special Reference to its Biological and Economic Aspects. (P. Blakiston's Son & Co., Philadelphia, 485 pp., with five plates (one coloured) and 300 text figures, $3.00.) The number of works in the entomologist's working library is already very large, but few active workers will be able to do without Dr. Folsom's recently issued magnificent work. In Packard's Guide, Comstock's Manual, and Kellogg's American Insects, classification is the prevailing idea, and is most useful and necessary; but in the present work the main object has been to supply in a concise form biological data. Familiar insects are used and the work is copiously illustrated with figures of the highest class. A short chapter on Classification, consisting of only 26 pages, begins the work. This, it may be thought, might have been extended to possibly twice its length with advantage. Chapter 2 on Anatomy and Physiology treats the subject in a delightful and fascinating manner. The same may be said of the next chapter on Development, in which typical insects only are dealt with in a suggestive manner. The titles of the remaining chapters are well chosen and the subjects effectively treated. They will be read with the greatest pleasure by all. Adaptations of aquatic insects, Colour and Coloration, Insects in relation to plants and to other animals, The Inter-relations of Insects, and Insects in relation to man, are subjects well dealt with in a concise and plain way, which can be understood by students. We believe that this work will do much to render the science of entomology much more popular than it must be acknowledged it has been in the past among students of agricultural colleges and others, notwithstanding the enormous economic importance of the subject, as shown by the annual losses in staple crops.

PACKARD, A. S. Monograph of the Bombycine Moths of North America, Part II, Ceratocampidæ. (Memoir IX, National Academy of Sciences, Washington, D.C., 1905, 4to, pp. 149, 61 plates, 24 coloured.) This is a most valuable work, giving full life-histories of the Ceratocampid moths of North America. The subject is treated of in Dr. Packard's masterly manner, and the plates, which are most beautiful, have been drawn by Messrs. J. Bridgham and L. H. Joutel, or are reproduced from photographs by Mr. A. H. Verrill. In looking through this work, we are sadly reminded that Dr. Packard's death removes one whose name has been such a watchword for good work in American entomology and takes a shining light from the ranks of the leading American scientific men who have done so much to uphold the standard of scientific excellence on this continent. The coloured illustrations, which are chromolithographs by A. Hoen & Co., of Baltimore, are simply exquisite, and the whole work supplies one of the most beautiful additions to the literature of the Lepidoptera of North America which has ever appeared. It is to be hoped that the National Academy may authorize Dr. Harrison G. Dyar or some of the many other accomplished lepidopterists of the United States to give to the public similar Memoirs upon other North American moths.

SMITH, J. B. Explanations of the Terms used in Entomology. (Published by the Brooklyn Entomological Society, Brooklyn, N.Y., price $2.00.) This most useful work, which perhaps answers more exactly to the trite expression that "it fills a long-felt want" than any recent publication, will provide many entomologists with a handy book of reference, which will enable them to understand the many useful, but in many instances unnecessary, unfamiliar terms which they frequently find in reading books dealing with the study of insects. This volume contains over 150 pages and explains between four and five thousand terms of more or less frequent use. One cannot read a page without feeling that many words have been made

use of by writers without any special need, and in some instances with the result of bewildering the reader without any compensating advantage. Four plates at the end of the work show structural details of the external body wall of some typical insects and the best known colours. As plates were given at all, it seems almost a pity that one or two more were not added, particularly one showing the markings and venation of the noctuidæ and some other orders in which Dr. Smith is the recognized authority. This handy little glossary will be found indispensable to all college students and other extensive readers of entomological literature.

The following is a list of the names and addresses of collectors heard from during 1906:—

Anderson, E. M., Prov. Museum, Victoria, B.C.
Baird, Thomas, High River, Alta.
Baker, Arthur, Harding Hall College, London, Ont.
Baldwin, J. W., 74 Besserer Street, Ottawa, Ont.
Bethune, Rev. Prof., O. A. C., Guelph, Ont.
Bryant, Theo., 2044 3rd Ave. W., Vancouver, B.C.
Bush, A. H., 1105 Ninth Ave., Vancouver, B.C.
Chagnon, Gus., Box 186, Montreal, Que.
Cockle, J. W., Kaslo, B.C.
Cosens, A., Jamieson Ave., Coll. Inst., Toronto, Ont.
Criddle, Norman, Treesbank, Man.
Denny, Edward, 200 Mitcheson St., Montreal.
Dod, F. H. Wolley-, Millarville, Alta.
Draper, R., Mt. Pleasant, Vancouver, B.C.
Evans, J. D., Trenton, Ont.
Fyles, Rev. T. W., Levis, Que.
Garrett, C., Galgary, Alta.
Gibbon, Hugh, Miniota, Man.
Grant, C. E., Orillia, Ont.
Hahn, Paul, Roxborough Ave., Toronto.
Halkett, A., Fisheries Museum, Ottawa.
Hanham, A. W., Duncans, B.C.
Harrington, W. H., P. O. Dept., Ottawa.
Harvey, R. V., Queen's School, Vancouver, B.C.
Heath, E. F., Cartwright, Man.
Hudson, A. F., Millarville, Alta.
Jarvis, T. D., O. A. C., Guelph, Ont.
Jones, W. A. Dashwood-, New Westminster, B. C.
Keele, Jos., Geological Survey, Ottawa.
Keen, Rev. J. H., Metlakatlah, B.C.
Lambe, L. M., Geological Survey, Ottawa.
Lyman, H. H., 74 McTavish St., Montreal.
McIntosh, W., Nat. His. Soc'y., St. John, N.B.
Marmont, L. E., Rounthwaite, Man.
Metcalfe, W., 288 Bank Street, Ottawa.
Mitchell, Arch., Dep. of Agriculture, Edmonton, Alta.
Moore, W. H., Scotch Lake, N.B.
Moore, G. A., 209 Prince Arthur St., Montreal.
Perrin, Jos., McNab's Island, Halifax, N.S.
Russell, John, Digby, N.S.
Sanson, N. B., Banff, Alta.
Saunders, Henry, 21 Harbord St., Toronto.
Sherman, R. S., 2285 Sixth Ave., Vancouver, B.C.

Simpson, Willibert, Dom. Observatory, Ottawa.
Stevenson, Chas., 906 St. Urbain St., Montreal.
Taylor, Rev. G. W., Wellington, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., 99 St. George St., Toronto.
Wallis, J. B., Office of Sup. Schools, Winnipeg, Man.
Williams, J. B., 236 Bloor St. E., Toronto, Ont.
Willing, T. N., Regina, Sask.
Wilmot, E. S., Vernon, B.C.
Wilson, W. J., Geological Survey, Ottawa.
Winn, A. F., 132 Springfield Ave., Westmount, Que.
Young, C. H., Hurdman's Bridge, Ont.
Zavitz, E. J., O. A. C., Guelph, Ont.

NOTES OF CAPTURES.

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U. S. N. M. Bull. No. 52.)

RHOPALOCERA.

(Dyar's number.)

51. *Callidryas philea*, L. St. John, N.B., Sep. 17, perfect specimen taken on dahlia blossoms, (McIntosh). This is the first Canadian record of this southern insect.

70. *Eurymus alexandra*, Edw., b. *emilia*, Edw. Kaslo, B. C., male and female seen but not captured, Aug. 19, (Cockle); Kalso, July 22, 1897, (Danby).

92. *Euptoieta claudia*, Cramer. Westmount, Que., one specimen seen Sept. 8, (Winn).

207. *Polygonia satyrus*, Edw. St. John, (McIntosh). The form *marsyas* was taken at Digby, N.S., by Mr. J. Russell.

223. *Junonia cœnia*, Hbn. Orillia, Ont., second specimen taken here, July, (Grant).

264. *Cercyonis œtus*, Bdv. Tranquille, B. C., July 7, (Lambe).

374. *Incisalia irus*, Godt, var. *arsace*, Bdl-Lec. Digby, N. S., 4 sps., May 5 to 22, (Russell).

383. *Erora læta*, Edw. Digby, June 7, (Russell).

463. *Amblyscirtes samoset*, Scudd. MacNab's Island, Halifax, N.S., quite abundant, (Perrin).

HETEROCERA.

661. *Lepisesia juanita*, Strk. A male in perfect condition, hovering over a thistle head in hot sunshine near Red Deer River, about 50 miles north-east of Gleichen, on July 6, 1905; agrees with Strecker's description, and is apparently the first record for Canada, (Dod).

674. *Argeus labruscæ*, L. St. John, Aug. 25, at light, (McIntosh). This is the only known Canadian record of this magnificant southern hawk moth.

704. *Sphinx luscitiosa*, Clem. Digby, N.S., July 15, 16, (Russell); Aweme, Man., May 27, June 10, 17, (Criddle). Montreal, July 17, (Can Ent. 38, p. 59).

778. *Basilona imperialis*, Drury. Ross Mount, Ont. Two perfect specimens, male and female, of this handsome moth, which is rare in Canada, were recently taken at the above place by Mr. T. W. Ramm, and presented to the Division of Entomology.

846. *Ecpantheria deflorata*, Fab. Niagara Glen, Ont., two larvæ, Sept. 18 and 20, one found feeding on violets, (Williams).

859. *Isia isabella*, S. & A. Kaslo, July 16, 2nd specimen taken by me here, the 1st in 1891, (Cockle).

875. *Apantesis virguncula*, Kirby. Milton, N.S. July 6, (W. H. Moore).

880. *Apantesis anna*, Grt. Niagara Glen, (Hahn).

961. *Demas propinquilinea*, Grt. MacNab's Island, Halifax, Feb. 11, (Perrin).

964. *Charadra deridens*, Gn. This handsome noctuid has this year been reported from several localities: Cartwright, Man., June 15, (Heath); Ottawa, June 22, (Young); June 4, (Fletcher); Digby, June 23, (Russell).

1,006. *Apatela tritona*, Hbn. MacNab's Island, Halifax, July 2, (Perrin).

1,008. *Apatela funeralis*, Grt. St. John's, Que., July 1, (Chagnon); Ottawa, (Young, Fletcher); Toronto, (Gibson).

1,149. *Hadena bridghami*, G. & R. Digby, Aug. 22, (Russell). St. John Aug. 20, (McIntosh).

1,153. *Hadena claudens*, Wlk. Kaslo, Aug. 28, (Cockle); Aweme, Man., Aug. 24, (Criddle & Fletcher).

Hadena ferens, Sm. Calgary, Alta., at light, July, 12, (Hudson).

1,189. *Hadena barnesii*, Sm. Kaslo. July 28, (Cockle).

1,212. *Hadena passer*, Gn. Digby, July 9, (Russell); Kaslo, July 21, (Cockle).

Hadena rorulenta, Sm. MacNab's Island, Halifax, July 5, (Perrin); Ottawa, June 23, (Young); Digby, June 29, (Russell).

1,228. *Hadena plutonia*, Grt. Meach Lake, July 17, (Young). First record for the Ottawa district.

1,230. *Hadena ducta*, Grt. Massett, Q. C. I., July 9, (Keen).

1,298. *Heliotropha obtusa*, Sm. Aweme, Aug. 19, (Criddle). Described from New Hampshire; never saw it since, (J. B. Sm.).

1,312. *Homohadena badistriga*, Grt., var. *fifia*, Dyar. Kalso, July 3, (Cockle).

1,345. *Oncocnemis glennyi*, Grt. Vernon, (Bush).

1,356. *Oncocnemis barnesii*, Sm. Kaslo, Aug. 19, (Cockle). The third known specimen.

1,359. *Oncocnemis balteata*, Sm. Aweme, Aug. 11, 22; Sep. 1, (Criddle). A rare and beautiful species.

1,390. *Rhynchagrotis rufipectus*, Morr. Ottawa, Aug. 9, (Young).

1,429. *Semiophora youngii*, Sm. Digby, N.S., Aug. 28, (Russell).

1,477. *Noctua esurialis*, Grt. Vancouver, B.C., July 20, (Bush).

1,480. *Noctua conchis*, Grt. Regina, Sask., July 11, (Willing).

1,484. *Noctua phyllophora*, Grt. Ottawa, June 22, (Fletcher); Digby, July 7, Aug. 3 (Russell); MacNab's Island, Halifax, July 15, 20, (Perrin).

1,492. *Noctua juncta*, Grt. Millarville, Alta., July 17, (Hudson).

1,560. *Pronoctua typica*, Sm. Kaslo, Sept. 9, (Cockle).

1,530. *Rhizagrotis albicosta*, Sm. High River, (Baird).

1,531. *Rhizagrotis flavicollis*, Sm. High River, Alta., (Baird).

1,533. *Rhizagrotis lagena*, Grt. A pair on Red Deer River, July 1 and 3, at snowberry flowers at dusk, (Dod & Hudson).

Paragrotis maimes, Sm. Calgary, common at light in early August; scarce for years past, (Dod & Hudson); High River, (Baird).

Paragrotis vestitura, Sm. Can. Ent. XXXVII., p. 20. St. John, usually rather abundant in August. It was from my specimens that Dr. Smith described the species, (McIntosh). McNab's Island, Halifax, Aug. 12, (Perrin).

1,579. *Paragrotis plagigera*, Morr. Spatsum, B.C., July 26, (Bush).

1,611. *Paragrotis acornis*, Sm. Calgary, Sep. 19, one at light, (Dod); High River, (Baird).

1,623. *Paragrotis detersa*, Wlk. The white larvæ almost identical in appearance with those of *Paragrotis scandens* were common around clumps of *Salsola Kali* and *Cakile Americana* on the sandy beach at Youghall, N.B., in July, (Fletcher).

1,697. *Paragrotis dissona*, Moschler. Banff, Aug. 10, (Sanson); Field, B. C., July 24, (Bush).

1,721. *Paragrotis furtivus*, Sm. Vancouver, July 11, (Bush); High River, (Baird).

1,731. *Paragrotis acutifrons*, Sm. Cartwright, July 17, one at sugar, (Heath).

1,732. *Paragrotis nordica*, Sm. Cartwright, July 11 and 17, at sugar, (Heath).

1,785. *Mamestra distincta*, Hbn. Meach Lake, Que., May 16, (Young).

1,788. *Mamestra liquida*, Grt. Kaslo, June 27, (Cockle).

1,804. *Mamestra larissa*, Sm. Aweme, June 3, (Criddle). *Teste* Dod.

1,806. *Mamestra rubefacta*, Morr. Digby, June 18, (Russell).

1,808. *Mamestra cristifera*, Wlk. Meach Lake, July 10, (Young).

1,809. *Mamestra assimilis*, Morr. Ottawa. Four mature larvæ found feeding on common St. John's-wort, *Hypericum perforatum*, Sept. 22, 1905. Emerged June 7, 1906, (Gibson).

1,851. *Mamestra pensilis*, Grt. Aweme, July 6 and 26, (Criddle). *Teste* Dod.

Mamestra obesula, Sm. Calgary, a few at light, July 12 to 25, (Dod & Hudson); Rosthern, Sask., July 21, (Willing).

1,882. *Barathra curialis*, Sm. This interesting species, which was so abundant in Canada during 1905, and which was mentioned in last year's Entomological Record, under the name *Barathra occidentata*, Grt., has again appeared in small numbers in some localities. Mr. Lyman and Mr. Winn report having taken it at Montreal in June; and Mr. Perrin, of MacNab's Island, Halifax, captured it on June 25, 27, and July 4.

1,906. *Scotogramma submarina*, Grt. About 8 specimens at snowberry flowers, at dusk, on Red River, July 1-4, (Dod & Hudson).

1,910. *Scotogramma uniformis*, Sm. Field, July 25, (Bush); Banff, July 16, (Sanson).

1,918. *Scotogramma conjugata*, Sm. Vancouver, taken from a railway car, July 7, (Bush).

1,941. *Anarta zetterstedti*, Staud. Field, B.C., July 25, (Bush).

1,965. *Heliophila diffusa*, Wlk. Aweme, June 17, (Criddle). *Teste* Dod.

2,000. *Orthodes irrorata*, Sm. Vancouver, June 29, July 16, (Bush).

2,042. *Graphiphora rubrescens*, Wlk. Ottawa, April 23, 25, (Young).

Fishia exhilarata, Sm. Kaslo, Oct. 10, (Cockle).

2,077. *Lithomoia germana*, Morr. Kaslo, Aug. 25; a new record for the interior of British Columbia, (Cockle).

2,086. *Xylina hemina*, Grt. Aweme, Apl. 23, and Sept., (Criddle). *Teste* Dod.

2,096. *Xylina amanda*, Sm. Aweme, Sept. 19, Oct. 1, (Criddle). *Teste* Dod; Miniota, Man., (Gibbon).

2,107. *Xylina tepida*, Grt. MacNab's Island, Halifax, Apl. 17, (Perrin); St. John, (McIntosh).

2,113. *Xylina capax*, G. & R. Cartwright, (Heath). *Teste* Dyar.

Xylina fletcheri, Sm. Meach Lake, Sept. 6, 7, (Young).

2,168. *Gortyna medialis*, Sm. Calgary, a worn male at light, Sep. 19, very rare of recent years, (Dod).

Gortyna pallescens, Sm. Kalso, Aug. 25, the only specimen taken since 1892, (Cockle). It is possible that Mr. Dod's specimen should be referred here.

2,175. *Papaipema harrisii*, Grt. var. Reared in some numbers from larvæ boring in the base of fronds of *Pteris aquilina*, Meach Lake, Aug., (Young). These larvæ were much parasitised.

2,191. *Papaipema appassionata*, Harvey. Reared from the roots of *Sarracenia purpurea*, Meach Lake, Aug., (Young). Many larvæ parasitised by *Masicera myoidea*. This most beautiful species is still very rare in collections.

2,213. *Tapinostola orientalis*, Grt. Calgary, two specimens at light, Sept. 8, (Hudson).

2,284. *Tapinostola variana*, Morr. Meach Lake, one specimen, July 7, (Young). A new record for Ottawa district.

2,473. *Polychrysia formosa*, Grt. MacNab's Island. Halifax, Aug. 17, (Perrin); St. John, July 19, (McIntosh).

2,516. *Autographa surena*, Grt. Quebec, Que., Aug. 12, 1902, (Hahn).

2,501. *Autographa alias*, Ottol. Dr. Ottolengui writes, "this species is found in nearly all collections under the name of *u-aureum*, a European species, the description of which does not fit anything in this country." Specimens have been received from St. John, (McIntosh); Halifax, (Perrin), and Ottawa, (Young).

2,503. *Autographa altera*, Ottol. McNab's Island, Halifax, (Perrin). Dr. Ottolengui writes: "The type of *altera* came from Nepigon, and I have a second specimen from the Adirondacks. Mr. Perrin's is the third. I am much interested in this specimen, because, being grayer than mine, it looks more like *variana*, but, placed between the types of these two species, which Dr. Dyar thought would prove to be the same, the specimen only emphasizes the fact, that both are species.

2,514. *Autographa celsa*, Hy. Edw. Vancouver, July 29, (Bush).

2,522. *Autographa excelsa*, Ottol. Sable Island, Aug. 19, 1899, (John Macoun). "I have been told that this species is not separable from *angulidens*, described from Colorado; but I have had over a hundred specimens of that before me, and every one has the silver mark with prolongations close together, and turned inwardly forming a U. I took my first *excelsa* in New Hampshire, and received others from Wolley-Dod, of Calgary. All that do not come from Colorado, have thus far had the typical V instead of the U silver mark. The genitalia also differ. You may feel safe in calling anything like this from Colorado, *angulidens*, as it seems as local as *vaccinii*. All others are *excelsa*." (R. Ottolengui.)

2,781. *Syneda graphica*, Hbn. Hope Mts., B.C., July 17, (Harvey).
2,872. *Catocala cerogama*, Gn. Cartwright, Aug. 18 and 20, one each night; this is, I think, a record for Manitoba. (Heath).
2,886. *Catocala cœlebs*, Grt. Digby, Aug. 14, (Russell).
2,990. *Homoptera minerea*, Gn. White River, Hudson Bay slope, June 2, (W. J. Wilson).
3,007. *Thysania zenobia*, Cram. Toronto, Sep. 19, (Hahn). This is the second record of this magnificent visitor from the South being taken in Canada.
3,150. *Schizura semirufescens*, Wlk. Vancouver, taken from railway car, July 28, (Bush); Cartwright, June 17, (Heath).
3,169. *Gluphisia lintneri*, Grt. Calgary, a male flying in sunshine, Apl. 19, (Hudson); Aweme, Apl. 18, 25, (Criddle); Ottawa, var. *arimacula*, Huds., May 23, (Young).
3,197. *Euproctis chrysorrhœa*, L. St. John, N.B., July 22, 1904, (A. Gordon Leavitt). The second Canadian record.
210. *Tolype distincta*, French. Kaslo, Aug. 17, (Cockle).
225. *Eudeilinea herminiata*, Gn. One on July 5, on Red Deer River, (Dod).
3,233. *Cysteropteryx viridata*, Pack. Meach Lake, May 17, (Young).
3,259. *Carsia paludata*, Thunb. Hope Summit, 5,800 feet, July 19, (Harvey).
3,287. *Eupithecia latipennis*, Hulst. Meach Lake, June 15, (Young).
3,276. *Eupithecia ornata*, Hulst. Ottawa, Apl. 24, May 4, (Young)
Eupithecia youngata, Taylor. Ottawa, June 7, July 20, (Young). This species was described in the "Ottawa Naturalist" for March, 1906.
Eupithecia casloata, Dyar. Meach Lake, Aug. 5, (Young).
3,350. *Eustroma propulsata*, Wlk. (*R packardata*, Lint.), a variety with antennæ dentate and probably in process of evolution towards a pectinated form. The ordinary form is simple ciliate. Frazer Falls, Y.T., Aug. 22, 1905, (J. Keele).
3,362. *Rheumaptera luctuata*, D. & S. a. *obductata*, Moesh, Lansing River, Y.T., June 24, (Keele).
3,425. *Cœnocalpe polygrammata*, Hulst. A pair on Red Deer River, July 3 and 6, (Dod & Hudson). The first records for Canada, (G. W. Taylor).
3,695. *Cymatophora brunneata*, Thunb. Hope Mts., July 20, (Harvey).
3,709. *Cymatophora latiferrugata*, Wlk. Ottawa, emerged from pupa, Aug., larva on *Prunus pennsylvanica;* black, with conspicuous white spots on sides, (Fletcher). A distinct species from *C. pustularia*.
3,734. *Cymatophora denticulodes*, Hulst. Two males at light on Pine Creek, July 22 and 25, (Dod). Hope Mts. July 18, (Harvey). New to Canada. (G. W. Taylor.)
3,773. *Platea trilinearia*, Pack. Not uncommon on Red River bottom, north-east of Gleichen, amongst prairie sage, *Artemisia ludoviciana*, in early July, (Dod & Hudson). Mr. Taylor says that this species was not previously known from Canada, with the exception of a possibly erroneous "B.C." record.
3,902. *Sicya macularia*, Harr. Sturgeon River, West of the Tamagami Region, July 17, (W. J. Wilson).
3,909. *Therina athasiaria*, Wlk. Meach Lake, June 17, (Young). The first record for the Ottawa district.

4,266. *Glaphria psychicalis*, Hulst. Trenton, one specimen, July 12, (Evans).
4,308. *Sylepta penumbralis*, Grt. Trenton, 4 specimens at light, May 17, Aug. 12, (Evans).
4,321. *Diaphania quadristigmalis*, Gn. Toronto, (Hahn).
4,323. *Metrea ostreonalis*, Grt. Meach Lake, July 16, very rare, (Young).
4,386. *Tholoria reversalis*, Gn. McNab's Island, July 10, 1904, (Perrin).
4,414. *Cindaphia bicoloralis*, Gn. Trenton, Aug. 20, at light, Evans).
4,455. *Pyrausta generosa*, G. & R. Trenton, at light, May 27, (Evans).
Eurrhypara urticata, L. Milton, N.S., July 6, 1906, (W. H. Moore). This common European species which feeds upon the stinging-nettle was first found by Mr. Moore, and was kindly identified by Dr. H. G. Dyar, who reported, "not known in North America." Since the receipt of Mr. Moore's specimens I have had an opportunity of examining Mr. Wm. McIntosh's collection in St. John, N.B., where I found several specimens of this moth. Mr. McIntosh tells me it is common in the district.
4,496. *Nymphula obliteralis*, Wlk. Trenton, 2 specimens, (Evans).
4,499. *Elophila bifascialis*, Rob. Trenton, 3 specimens, Aug. 14, (Evans).
4,519. *Herculia cohortalis*, Grt. Trenton, June 30, Aug. 6, (Evans).
4,544. *Schœnobius tripunctellus*, Rob. Trenton, one specimen, June 25, at light, (Evans).
5,014. *Exartema zellerianum*, Fern. Trenton, July 19, (Evans).
Eucosoma confluana, Kearf. Trenton, one specimen, at light, Aug. 24, (Evans).
5,287. *Ecdytolopha insiticiana*, Zell. Trenton, 2 specimens, June 25, and Aug. 24, at light, (Evans).
5,336. *Cenopis Pettitana*, Rob. Trenton, (Evans); Ottawa, larva on basswood, May 31; pupa, June 7; moth, June 16, (Gibson).
5,419. *Eulia quadrifasciana*, Fern. Trenton, two specimens, July 8 and 22, at light, (Evans).
5,818. *Gelechia omatifimbriella*, Clem. Trenton, at light, June 25, and July 7, (Evans).
5,865. *Depressaria psoraliella*, Walsm. Trenton, one specimen, at light, Sept. 5, (Evans).

The following valuable notes on some species of microlepidoptera have been received from Mr. W. D. Kearfott, and are gratefully included:

"Since the brief list of notable captures was written for the 1904 Entomological Record, I have had the privilege of examining a very large number of Canadian specimens, and mention the following as being especially interesting. Several of them are new records for Canada.

"This list could be continued almost indefinitely, but its usefulness is limited, because there is no strictly Canadian list of Lepidoptera. I would strongly urge the compilation of such a list. With such a basis to work from, the friendly rivalry to add names to it would be very much stimulated. I have records of several hundred names of Microlepidotera, and my notes and help are freely offered to any one who may care to undertake this task.

"I desire again to extend my sincere thanks to the gentlemen who have so kindly sent me their material for examination and determination, and for their most generous treatment in the cases of unknown and desirable species, especially Messrs. Young, Criddle, Marmont, Heath, Evans, Willing, Dennis, Taylor, Saunders, Winn, Gibson and Fletcher.

4,569. *Crambus bidens*, Zeller. Specimens of both sexes from Mr. Young, Ottawa, July 11. Very rare as yet in general collections.

4,583. *Crambus myellus*, Hbn. Hurdman's Bridge, Ont., July 26-30. This species is recorded from Europe, Maine and Nova Scotia. It is very rarely met with, and Mr. Young's specimens are the first I have seen.

5,137½. *Eucosma suffusana*, Zell. This European species has never been recorded from America, but is likely to prove of considerable economic importance after a few years. I have recently received specimens for determination from several localities in New Jersey and Pennsylvania, Portsmouth, N.H., and Regina, Sask., (Willing), August 15. Early this spring I bred the moths from larvæ crumpling and rolling the young leaves of my rose bushes and eating the entire bud. The larva is transparent pinkish green, almost slug-like in shape. I have not had it from Eastern Canada; but it will be found wherever roses grow.

5,189. *Thiodia signatana*, Clem. Received from Mr. Gibson, and labelled "Miner in maple leaves, Kirk's Ferry, issued Sept. 18." This species is quite common in Montclair and, during June, can be found in abundance on the trunks of the red maple.

The larvæ are found in September, living in a tube on the underside of the leaf, and still further protected by a web of silk across the leaf, from edge to edge. It would be interesting to know if its habits are different at Kirk's Ferry; possibly the term "Miner" referred only to the young larvæ, immediately out of the ova.

5,298. *Carpocapsa toreuta*, Grote. One specimen received through Dr. Fletcher, labelled "Bred from cone of *Pinus ponderosa*, British Columbia (Interior), (J. R. Anderson)." This is another very rare species; only one or two other specimens are known.

5,325. *Acleris angusana*, Fern. Hurdman's Bridge; bred from larvæ webbing the leaflets of hemlock. Mr. Young sent me eight specimens, exhibiting a great range of variability; a narrow band from base to apex connects them all; but this band ranges from pure white, through the reds to black. The ground color, likewise, in different specimens, ranges from pale yellow, through the reds to purplish black, and in some of the specimens a white transverse angulated band through the middle of the wing; in others, the outer half is paler than the inner. On p. 849, Fifth Report Ento. Comm., Packard records the breeding of this species from spruce and fir, but calls it Var. "E" of *Teras variana*, Fern.

5,475. *Carposina crescentella*, Wlsm. Hurdman's Bridge, (Young); locality "unknown" in Dyar's list; it has also been taken in Western Pennsylvania, (Merrick).

5,488. *Periclymenobius canariellus*, Wlsm. Hurdman's Bridge, (Young); Rounthwaite, (Marmont). The three species under this genus can easily be recognized by the scythe-like extension of the cilia of the apex of the fore wings, making them veritable hook-tips; I believe all three will be found in Canada from Ottawa westward. I have already recorded *P. frustellus* from Aweme, (Criddle), and Cartwright, (Heath), and also have *canariellus* from Wellington, B.C., (Taylor) and Arizona, (Kunze).

5,918. *Euclemensia bassettella*, Clem. Hurdman's Bridge, (Young).

This is one of the most beautiful of the larger Tineids, a long bar of crimson on an opalescent-black back-ground. It has been

bred from larvæ feeding within small yellowish brown, shining galls on twigs of oak. I do not believe this larva is the cause of the gall, but it makes use of the habitat of a generous (?) Dipteron.

ADDITIONS TO THE MANITOBA LIST.

4,521. *Herculia olinalis*, Gn. Aweme, VII., 26 to VIII, 6.
4,566. *Crambus unistriatellus*, Pack. Aweme, VIII, 17.
4,737. *Nephopteryx hypochalciella*, Rag. Aweme VIII, 16.
4,871. *Homœosoma mucidellum*, Rag. Aweme, VI., 12.
4,965. *Pterophorus subochraceus*, Wlsm. Aweme, VI., 12.
5,018. *Exartema versicoloranum*, Clem. Aweme, VII, 12-15.
5,022. *Exartema corylanum*, Fern. Aweme, VII., 6-12.
5,071. *Olethreutes bipartitana*, Clem. Aweme, VI, 21 to VII, 5.
5,073. *Olethreutes impudens*, Wlsm. Aweme, VII., 27.
5,132. *Eucosma hirsutana*, Wlsm. Aweme, VI., 14 to VII., 4.
5,150. *Eucosma carolinana*, Wlsm. Cartwright.
5,255. *Ancylis divisana*, Walk. Aweme, VI., 26-27.
5,274. *Enarmonia lunatana*, Wlsm. Aweme, V, 18 to VI, 7.
Ancylis cockleana, Kearf. Aweme, VII., 20.
5,339. *Cenopis groteana*, Fern. Winnipeg, Hanham.
5,407. *Tortrix packardiana*, Fern. Aweme, VI., 12.
5,834. *Stenoma schlægeri*, Zell. Aweme, VI, 21.
5,912. *Ethmia longimaculella*, Cham. Aweme, VI., 21.
6,108. *Scythris eboracensis*. Zell. Aweme, VI., 27 to VII., 7.

W. D. K.

The following species of geometridæ have been described in the "Canadian Entomologist" for 1906, by the Rev. G. W. Taylor, of Wellington, B.C., from different parts of Canada.

Eupithecia regina. Regina, Sask., June 25, (Willing); Calgary, June 29, July 7, to Aug. 8. (Dod).

Eupithecia alberta. Calgary, June 30, (Dod).

Eupithecia dodata. Calgary, June 26, and July 3, (Dod).

Eupithecia adornata. Calgary, May 25, to June 14, (Dod).

Xanthorhoe circumvallaria. Millarville, June 26, July 24, (Dod).

Aplodes hudsonaria. Fifty miles N.E. of Gleichen, Alberta, July 7, (Hudson); Victoria, August, 1903, (Hanham).

Eupithecia olivacea. Wellington, April 7, 1903, (Taylor); not uncommon at Vancouver (Harvey).

Eupithecia harveyata. Vancouver, Apl. 6, 1903, (Harvey).

Eupithecia dyarata. Kalso, Apl. 24, not uncommon, (Cockle).

Eupithecia hanhami. Victoria, June, (Hanham).

Eupithecia bryanti. Stickeen River, B.C., July, (Bryant).

Eupithecia obumbrata. Victoria, April to June, (Hanham).

Eupithecia modesta. Vancouver, June 6, (Taylor).

Eupithecia insignificata. Wellington, Victoria and Vancouver, March to May, (Taylor).

Euphithecia sublineata. With above, and thought to be a variety of it.

Eupithecia perbrunneata. Kaslo and Victoria, May 9 to June 2, (Cockle and Taylor).

Eucymatoge vancouverata. Wellington, Vancouver.

Eustroma harveyata. Kaslo, Stickeen River, Vancouver.

Zenophleps victoria. Victoria, (Hanham).

Hydriomena autumnalis, Strom., var. *columbiata*. Victoria, Wellington, May.

Hydriomena manzanita. Wellington, April.
Xanthorhoe pontiaria. Wellington; Salem, Oregon.
Xanthorhoe fossaria. Laggan, Alta., and Mt. Cheam., B.C., (Bush).
Leptomeris subfuscata. Victoria, (Hanham); Vernon, (Harvey).
Deilinia bryantaria. Stickeen River, June 13, (Bryant).
Enypia packardata. Wellington, June to August.

Several species of European geometridæ have been recognized in Canada, for the first time during the year, viz.

Eupithecia castigata, Hbn. Wellington, (Taylor); Calgary, (Dod).
Eupithecia togata, Hbn. Wellington, (Taylor).
Hydriomena ruberata, Freyer. Calgary, (Dod).
Himera pennaria, L. Tamarisk, Man., 1903, (L. Fanshawe).

Coleoptera.

(Arranged according to Henshaw's List of the Coleoptera of America, North of Mexico.)

36. *Cicindela cinctipennis,* Lec. Vernon, B.C., May, one specimen on damp sand, (Venables).
109. *Cychrus angulatus,* Harr. Duncans, B.C., April, (Hanham).
871. *Lebia devisa,* Lec. Regina, April 15, (Willing).
898. *Lebia depicta,* Horn. Regina, Oct. 11, (Willing).
1,487. *Dytiscus circumcinctus,* Ahr. Winnipeg, "On a sultry evening in October my son Evan collected about 100 specimens, half of them males; of the females four had sulcate elytra. Prof. Wickham who named my specimens, writes: 'The first American specimens I have seen. The original American locality is Red River, and they may have come from Winnipeg," (Evans).
2,661. *Boletobius cincticollis,* Say. Aweme, in woods, April 9, (Criddle).
2,829. *Olophrum marginatum,* Kirby. Sudbury, one specimen, (Evans).
2,899. *Siagonium americanum,* Melsh. Sudbury, one specimen, (Evans).
3,696. *Epuræa helvola,* Er. Aweme, at putrid bird, June 3, (Criddle).
3,984. *Aræopus monachus,* L. Vernon, on willow blossom, (Venables).
4,005. *Holodes thoracica,* Guer. Como, Que., July, Aug., (G. A. Moore).
4,275. *Ludius abruptus,* Say. Ottawa, June 20, (Fletcher).
9,394. *Chrysobothris ludificata,* Horn. Aweme, April 10, July 16, (Criddle).
5,022. *Malachius æneus,* L. Ottawa, June 6, (Fletcher); July 1, (J. A. Guignard). An addition to the Ottawa list.
5,177. *Clerus nigriventris,* Lec. Vernon, on pine stump, July 15, (Venables).
5,359. *Dinoderus substriatus,* Payk. Barrie, Ont., in hemlock bark, Oct., (Zavitz).
5,384. *Hylecœtus lugubris,* Say. Fort Kent, Maine, 1900, opposite St. Francis, N.B., (Rev. F. X. Burque).
5,525. *Aphodius fœtidus,* Fab. Aweme, April 26, May 4, (Criddle).
5,961. *Prionus californicus,* Mots. Grierson's Wharf, on the Ottawa near Fitzroy Harbour, July 30, (Metcalfe). A wanderer from the Pacific Coast.
6,079. *Tylonotus bimaculatus,* Hald. Guelph, on black ash, July, (Zavitz).
6,106. *Ancylocera bicolor,* Oliv. Ridgeway, on hickory, Aug., (Zavitz).
6,238. *Toxotus schaumii,* Lec. Galt, on maple, August, (Dr. Bethune).
6,304. *Leptura subhamata,* Rand. Guelph, August, (Zavitz).
6,345. *Leptura biforis,* Newm. Ridgeway, August, (Zavitz).
6,385. *Monohammus titillator,* Fab. Rondeau and Ridgeway, on white pine, June to August, (Zavitz).
6,397. *Goes pulchra,* Hald. Ridgeway, on hickory, August, (Zavitz).

6,577. *Crioceris asparagi*, L. Ottawa, larvæ found Sept. 20, buried Sept. 22, emerged at end of October; the furthest eastern record in Ontario, (Fletcher & Gibson). Not previously found at Ottawa.
7,396. *Cœlocnemis dilaticollis*, Mann. Vernon, June, (Wilmot).
7,852. *Mordellistena bihamata*, Melsh. Como, Que., June and August, (G. A. Moore).
7,873. *Stereopalpus mellyi*, Laf. Como, July and August, (G. A. Moore).
8,101. *Epicauta fissilabris*, Lec. Saskatoon, June 6, (Willing).
8,611. *Magdalis perforata*, Horn. Ridgeway, Aug., on white pine, (Zavitz)
8,619. *Magdalis subtincta*, Lec. Greenbush, Man., bred from twigs of white spruce, March 4, (Willing).
8,634. *Anthonomus profundus*, Lec. Trenton, one specimen, Sept. 27, '03. This has not been so far reported from Canada, (Evans).
9,203. *Gonotropis gibbosus*, Lec. Aweme, April 29, (Criddle).
9,748. *Cryptorhynchus lapathi*, L Ridgeway and Beamsville, June 23 to July 30, (Zavitz). Toronto, on one willow only in High Park, but this was completely riddled, (A. Cosens). This destructive weevil which attacks poplars and willows is gradually spreading through North America. These are the first Canadian records.

Diptera.

(Arranged according to a Catalogue of North American Diptera by J. M. Aldrich. Smithsonian Misc. Coll., XLVI, No. 1, 444. The numbers refer to the pages of the Catalogue.)

171. *Bibiocephala grandis*, O. S. Hope Mts., B.C., July 14, (Harvey).
196. *Chrysops delicatulus*, O. S. St. John, July 2, (McIntosh).
196. *Chrysops frigidus*, O. S. Hope Mts., July 18 to 27, (Harvey).
198. *Chrysops proclivus*, O. S. St. John, July 21, (McIntosh).
203. *Tabanus fratellus*, Will. Hope Mts, July 18 to 25, (Sherman).
Tabanus osburni, Hine. Hope Mts., July 12 to 25, abundant, (Sherman and Harvey).
209. *Tabanus zonalis*, Kby. Kaslo, (Cockle).
227. *Dipalta serpentina*, O. S. Goldstream, B.C., Aug. 19, (Harvey).
Anthrax harveyi, Hine. Hope summit, 5,800 feet, seven specimens, July 20 and 24, (Sherman and Harvey).
241. *Eclimus harrisii*, O. S. St. John, (McIntosh).
256. *Stenopogon modestus*, Lw. Similkameen, July 21, 22, common, (Sherman and Harvey).
258. *Dicolonus simplex*, Lw. Victoria, June 8, (Harvey).
259. *Cyrtopogon aurifex*, O. S. Hope Mts., July 12 to 27, common, (Sherman and Harvey).
259. *Cyrtopogon dasylloides*, Will. Kaslo, (Cockle).
296. *Hydrophorus innotatus*, Lw. St. John, (McIntosh).
383. *Pyritis montigena*, Hunter. Vancouver, Feb. to Apl., (Sherman).
386. *Eristalis inornatus*, Lw. St. John, June 5, (McIntosh).
Merodon equestris, Fab. Vancouver, several specimens, (Harvey).
401. *Crioprora alopex*, O. S. Vancouver, March 24, (Sherman).
405. *Temnostoma æqualis*, Loew. Haydon, Ont., July 31, (E. B. Williamson).
412. *Myopa pictipennis*, Will. Vancouver, April 14, (Harvey).
Cuterebra grisea, Coq. Hope Mts., July 12, (Sherman).
419. *Cuterebra tenebrosa*, Coq. Kaslo, July 20, (Cockle), Vernon, July, (Wilmot). A magnificent blue-black species nearly an inch long and almost one-half inch across the abdomen.

422. *Cistogaster immaculata*, Macq. Hope Mts., July 15, (Harvey).
466. *Masicera myoidæa*, Desv. Meach Lake, bred from *Papaipema appassionata*, (Young).
527. *Mesembrina resplendens*, Wahl. Kaslo, (Cockle).
605. *Trypeta straminea*, Doane. Wellington, July, 1904, (Harvey).
608. *Carphotricha culta*, Wied. Wellington, June, 1905, (Harvey).
611. *Tephritis albiceps*, Lw. Victoria, June 8, (Harvey).

HEMIPTERA.

We are glad to note an awakening of interest in this important order. Collections have been submitted to Mr. E. P. Van Duzee and kindly named by him, from Mr. W. J. Palmer, of Buffalo, the Rev. G. W. Taylor, of Wellington, B.C., and Mr. G. A. Moore, of Montreal. A list of Mr. Palmer's collection taken near Lake Temagami, Ont., appears in the *Canadian Entomologist* for 1906 at page 406. Some of Mr. Taylor's new species are described in *Entomological News* for Dec., 1906, page 388, and Mr. Moore's collection taken at Como, Que., will be published in an early number of the *Canadian Entomologist*.

The following are considered by Mr. Van Duzee of special interest:—

HETEROPTERA.

Sehirus cinctus, P. B. Como, July 24, one specimen, (Moore).
Banasa dimidiata, Say. Como, Aug. 12, one specimen, (Moore).
Alydus eurinus, Say. Como, July 20, (Moore).
Protenor belfragei, Hagl. Como, Aug. 2, two specimens, (Moore).
Mysius longiceps, Stal. Como, July 25, two specimens, (Moore).
Ligyrocoris contractus, Say. Como, July 26, several, (Moore).
Peritrechus tristis, V. D. Victoria and Wellington, B.C., March, April and October, (Taylor).
Eremocoris obscurus, V. D. Wellington, March and April, (Taylor).
Phlegyas abbreviatus, Uhl. Como, July 26, several, (Moore).
Scolopostethus thomsoni, Reut. Como, July 2, one specimen, (Moore).
Aradus abbas, Prov. Como, July 1, one specimen, (Moore).
Plagiognathus politus, Uhl. Como, July 15, (Moore); Swamp Creek, and Island Lake, Temagami District, Aug. 14 and 12, (Palmer).
Plagiognathus annulatus, Uhl. Como, July 2, (Moore); Island Lake, two specimens, Aug. 12, (Palmer).
Hyaliodes vitripennis, Say. Como, July 20, (Moore).
Pilophorus crassipes, Stal. Como, two specimens, July 24, (Moore).
Phytocoris puella, Reut. Como. Aug. 2, (Moore).
Phytocoris pallidicornis, Reut. Como, July 14, (Moore).
Melinna modesta, Uhl. Como, July 20, Aug. 1, (Moore).
Pœcilocapsus marginatus, Reut. Como, July 8, (Moore).
Trigonotylus ruficornis, Fall. Como, July 2, (Moore).
Mesovelia bisignata, Uhl. Como, Aug. 1, (Moore).

HOMOPTERA.

Thelia univittata, Harr. Como, July 27, one specimen, (Moore).
Archasia galeata, Fitch. Como, July 7, one specimen, (Moore).
Ophiderma salamandra, Fairm. Como, Aug. 3, one specimen, (Moore).
Carynota marmorata, Say. Como, July 23, (Moore).
Pissonatus marginatus, V. D. Como, July 8, one specimen, (Moore).
Laccocera vittipennis, V. D. Como, July 25, one specimen, (Moore).
Phyllodinus nervatus, V. D. Como, July 14, one specimen, (Moore).

Clastoptera proteus, Fitch, var. *flava*, Ball. Como, July 24, (Moore).
Clastoptera proteus, Fitch, var. *vittata*, Ball. Como, July 25, (Moore).
Clastoptera proteus, Fitch, var. *nigra*, Ball. Como, July 25, (Moore).
Bythoscopus variabilis, Fitch. Como, July 14, on oak, (Moore).
Pediopsis insignis, V. D. Como, July 20, (Moore).
Oncometopia costalis, Fab. Como, July 27, two specimens, (Moore).
Dræculacephala manitobiana, Ball. Swamp Creek, Temagami district, Aug. 14, (Palmer).
Dræculacephala noveboracensis, Fitch. Como, July 2, (Moore); Red Cedar Lake, Aug. 9, (Palmer).
Xestocephalus pulicarius, V. D. Como, one specimen, Sept. 2, (Moore).
Paramesus vitellinus, Fitch. Como, July 26, several, (Moore).
Platymetopius acutus, Say. Como, July 20, Aug. 4, (Moore).
Scaphoideus auroniteus, Prov. Como, July 30, one specimen, (Moore).
Athysanus plutonius, Uhler. Como, July 2, (Moore).
Eutettix seminuda, Say. Como, July 8, one specimen, (Moore).
Thamnotettix smithii, V. D. Swamp Creek, Aug. 14, (Palmer).
Thamnotettix eburata, V. D. Red Cedar Lake, Aug. 9, Island Lake, Aug. 12, and Swamp Creek, Aug. 14, (Palmer).
Thamnotettix waldana, Ball. Swamp Creek, Aug. 14, (Palmer).
Jassus olitorius, Say. Como, Aug. 12, (Moore).
Empoasca viridescens, Walsh. Como, July 31, (Moore).
Eupteryx flavoscuta, Gill. Como, July 15, several, (Moore).
Typhlocyba tricincta, Fitch. Como, July 2, (Moore).
Typhlocyba bifasciata, G. & B. Como, July 21, (Moore).

Odonata.

Up to the present time, although a good deal of work has been done spasmodically in working up the Dragon-flies of Canada by collectors in different parts of the Dominion, as far as I am aware, no complete Canadian list has ever been prepared. That this should be taken in hand at once, is most desirable, both on account of the important role played by these insects and also from their attractive nature. Some years ago Mr. T. J. McLaughlin worked up the species of the Ottawa district, and Dr. E. M. Walker, of Toronto, has recently made extensive studies of the Odonata of the whole Province of Ontario. Up to the end of last year he had listed 65 species, and a few others have been added during the past summer. A list of 37 British Columbian species prepared by Prof. Raymond C. Osburn, of New York, is reproduced from *Entomological News* in the September Bulletin of the British Columbia Entomological Society. As already mentioned, Mr. E. B. Williamson, of Bluffton, Ind., made a short trip into Northern Ontario during the past summer for the special purpose of collecting Odonata, and Mr. McIntosh has collected in New Brunswick.

Entomologists will be pleased to learn that Dr. E. M. Walker has undertaken a complete revision of the genus *Æschna* in North America. He thinks that "the determinations of the species have been to a large extent guess work, and that not sufficient account has been taken of the females and of the colour markings." Dr. Walker writes: "I have already come to pretty definite conclusions as to the limits of the species, and find there are several more than has been believed by the best authorities to be the case. Females and colour pattern prove to be of great importance and individual variations within the species but slight. I am going to verify as far as possible my conclusions in the field next summer, but would like to

examine as much material as possible this winter. I shall be glad to receive any material in this genus, which will be taken great care of and returned named as soon as I have finished with it." This excellent opportunity for getting material worked up should not be neglected by collectors, and it is to be hoped that all will assist Dr. Walker to the full extent of their ability in this useful undertaking.

A small collection of Odonata collected in the Temagami district by Mr. W. J. Wilson, of the Geological Survey, in 1905, has been named by Prof. J. G. Needham, who reports as follows: "These are all more or less common throughout eastern Canada; but the specimens are of much interest, as they extend the known northward range for practically all of them." The list is as follows:—

Gomphus sordidus, Hagen. Kokokosing Lake, June 13, and Sturgeon River, June 29, 4 males and 8 females.

Gomphus exilis, Selys. Smooth Water Lake, June 22, 2 males.

Calopteryx maculata, Beauv. Sturgeon River, July 29, July 16.

Hagenius brevistylus, Selys. Kettle Falls, Sturgeon River, June 30.

Æschna clepsydra, Say. Kettle Falls, Sturgeon River, June 30.

Dr. Walker sends the following records:—

Somatochlora walshii, Scudd. DeGrassi Point. First Ontario record.

Somatochlora williamsonii. "I am about to describe under this name some specimens which I have had in my collection for several years, but I was not certain until recently that they were distinct from *S. elongatus*, Scudd. Mr. Williamson has taken the species in Michigan and Prof. Needham in New York. The former had recognized it as a new species and has turned his material over to me. The description will appear in the *Canadian Entomologist*. Ontario records: Toronto, DeGrassi Point, Lake Temagami." (Walker.)

Enallagma pollutum, Hag. Bala, Muskoka, Aug. 25, (W. J. Fraser).

Gomphus adelphus, Selys. Hull, P.Q., June 29, 1886, (Fletcher). The first Canadian record.

Gomphus brevis, Selys. Hull, P.Q., June 29, 1886, (Fletcher); Cumberland Ont., June 16, 1900, (Gibson).

Æschna juncea, L. Anticosti, 1902, (Dr. Joseph Schmitt); DeGrassi Pt., Lake Simcoe, Ont., Sep. 2, (Walker).

Basiæschna janata, Say. Clarke's Bush, Ottawa, May 2, 1902, (Gibson).

Macromia illinoiensis, Walsh. Hull, P.Q., June 29, (Fletcher).

Helocordulia uhleri, Selys. Buckingham, P.Q., May 31, (Fletcher).

Tetragoneuria spinosa, Selys. Hull, P.Q., May 22, 1886, (Fletcher).

Leucorhinia hudsonica, Selys. Short Bay, on Behm Canal, B.C., August 11, (J. A. Cadenhead); Anticosti, (Dr. Schmitt); Laggan, Alta., (T. E. Bean); Eastman's Springs, Ont., May 25, Hull, P.Q., June 29, (Fletcher).

Sympetrum costiferum, Hag. Victoria, B.C., (Fletcher).

Sympetrum corruptum, Hag. Banff, Alta., Sept. 13, 1897, (N. B. Sanson); Laggan, Alta., (T. E. Bean).

Tramea lacerata, Hag. Several fresh examples of this large southern dragonfly were seen near Grenadier Pond, Toronto, Sept. 15, 1906. I had no net, but succeeded in capturing a fine male. A few days afterwards they had all disappeared. (Walker.)

IN THE TRACKS OF NEMATUS ERICHSONII, HARTIG.

By Rev. Thomas W. Fyles. D.C.L., F.L.S.

It is a law of nature that no particular growth of plants should hold possession of the land in perpetuity. Sooner or later destructive agents will break in upon the scene. Insect depredators, drought, fire, storm and flood —*these*, and the axes of the lumbermen, make clearances for occupation by the settler, or for Nature's re-planting. In the latter case we find that the new growth is, generally speaking, different from the old. The following affords a curious exemplification of this fact:—

In 1842, when the Ashburton Treaty was made, a strip, 60 feet wide, was cut along the border, through the tamarack swamps that extend from Canada into New Hampshire and Maine. This strip is now filled up with a new growth; but the forester knows directly when he strikes the line, for he finds a belt in which the poplar (*Populus tremuloides*), the red cherry (*Prunus Pennsylvanica*), and the Moosemissie (*Pyrus Americana*), are growing, the seeds of the first having been carried by the wind into the Boundary, when newly cleared; and those of the last two, by birds.

Thirty years ago it was a fine sight to look, from an elevation, upon the vast area of swamp land, extending through Bury, Lingwick, Hampden, Ditton, and far away. Tamaracks from two feet to two and a half feet in diameter, were the lords of this forest-land. To-day, I have the authority of Mr. Ayton Cromwell and Mr. C. C. Lusk, of Cookshire, and Mr. C. H. Ward, of Bury—all experienced foresters—for stating that not a single first-growth tamarack is to be found in the whole section. And like testimony comes to me from Mr. John D. Johnson, of St. Thomas, and Mr. E. W. Brewster, of Compton, in regard to the districts with which they are respectively acquainted.

How was the destruction brought about? By an agent seemingly insignificant and wholly unexpected—a four-winged fly, belonging to the order *Hymenoptera*, and named by Hartig, *Nematus Erichsonii*.

This fly is only about eight-tenths of an inch in expanse of wings, and four-tenths in length of body. Its colour is black, but it has a broad orange-red band round the abdomen. Its wings are clear, with dark veins, and a conspicuous costal spot or *stigma*.

In the larval stage—which is the destructive stage—the species is a green caterpillar of no great size, having a black head. When it is "full-fed," it creeps into some retreat, and spins a compact, brown cocoon, about half an inch in length.

It was in the pupal stage, probably, and amongst the roots of young plants of Norway Spruce, that the species was brought to the nurseries of Massachusetts, about the year 1880.

The first notice of the arrival of the *Nematus* in Canada was given by myself, and will be found on the 17th page of the Report of the Entomological Society of Ontario for 1883. When the creatures came to us, they came in their strength—"In numbers numberless." The Nematus Raid, as it was called, was a phenomenon that they who witnessed are not likely to forget. That creatures seemingly so insignificant, brought unwittingly from a country so far away, should, by force of numbers, be able to strip the vast forest of tamarack of its verdure, and leave the trees in a dying state was truly marvellous.

I last saw the creatures in activity about ten years ago, in a grove of young tamarack near the old St. Henry Road, in Levis County. The trees were about twenty feet high; and here and there amongst them was a small

colony of Nematus larvae. The grove mentioned has lately been felled, and the land it occupied turned into a pasture.

The Nematus larvae had a preference for the finest growths. The smaller trees of the time were not at first so badly treated by them; and these lingered on, making brave efforts at recovery; but even these have for the most part, now succumbed. Probably the drought of 1903 gave the finishing blow to them.

Mr. E. B. Brewster tells me that half a mile from Compton Village, there is a tamarack swamp about a mile long and one-eighth of a mile wide. The largest trees in it are ten or twelve inches in diameter. Of all the trees in the swamp, probably 75 per cent. are dead, and about 15 per cent. show some signs of feeble life in tufts of sprouts from the stem. The only apparently healthy trees are on the borders of the swamp, and form a mere narrow fringe to it, one or two trees deep.

Of the dead trees in this swamp, some are only "rampikes," denuded both of branches and bark. To others the branches still cling. Here and there, among the dead trees, a few balsams (*Abies balsamea*) and cedars (*Thuja occidentalis*) are springing up.

When I visited the swamps in Bury in 1891, the rot had struck into the dead trees for two or three inches. For an account of this visit, and a calculation of the damage done by the Nematus, see the Report of the Entomological Society of Ontario for 1891, page 28.

When the Rutland Railway into Canada was in contemplation, dead tamarack trees lay so thickly in the swamp half way between Alburgh and Noyan, that they had to be hauled out of the way, before the survey for the line could be effected. This was in the fall and winter of 1898-9. The authority for this statement is Mr. Alanson Vosburgh, per Miss May G. Johnson of Miranda, P.Q.

In the part of Bury where I saw Maddock's gang getting out the knees for vessels in 1891, the land has been brought under cultivation.

A few notes to tell further of the kinds of trees that are springing up in place of the tamarack may be desirable.

In the Ditton Swamp, which is about three miles long and a mile broad, the tamaracks young and old are all dead. Spruce is taking their place.

In the Spalding Hill Swamp, in Eaton Township, cedar, poplar and some young tamarack are growing.

In the Harrison neighborhood in Bury Township, in parts where the soil is sandy, white birch and a few balsams are growing; on wet clay, the poplar appears.

In Long Swamp, which extends through Newport, Hampden, and over to Lingwick, spruce and balsam are growing.

To those who would see a tamarack swamp in its infancy, I would recommend a visit to "The Gomin," which lies to the west of Bergerville, about four or five miles from Quebec. In the early Summer it is all aglow with rhodora, sheep-laurel, orchids and pitcher-plants. When I first saw it in 1886, it was a broad expanse of sphagnum, unoccupied, save on its outskirts, by any larger plants than those I have mentioned. I re-visited the swamp on the 10th of July last, and found that it was dotted all over with young tamarack from a foot to fifteen feet high. On the borders of the swamp near the cultivated land there were tamaracks twenty-five feet high or more.

Doubtless, if left undisturbed, the growth on this tract will, in process of time, become a forest. And so—

"The old order changeth and giveth place to new."

THE NOTODONTIDAE OF THE PROVINCE OF QUEBEC.

BY REV. THOMAS W. FYLES, D.C.L., F.L.S.

This interesting group of insects is not as well known as some other families of the Lepidoptera. *Datana ministra* Drury, *Nerice bidentata* Walker, *Summerista albifrons* Smith and Abbot, and *Schizura concinna* S. and A. are not uncommon with us; but other species are extremely rare; such are *Odontosia elegans* Strecker, *Dasylophia thyatiroidea* Walker, *Heterocampa pulverea* Grote and Robinson, and *Cerura multiscripta* Riley. Of each of these kinds I have taken but one specimen in many years.

Imagos of the different species are sometimes attracted by light, and sometimes they are found at rest on palings and the bolls of trees. They are generally regarded as prizes by Entomologists.

The larvae of most of the Notodontidae are remarkable objects. Some of them assume grotesque attitudes; for instance *Datana ministra* Drury, which raises the fore and hindmost parts of its body in a threatening manner and takes the form of a bow. Some, in their early stages, are strangely horned, as is the case with *Heterocampa guttivitta* Walker in the first stage, and with *Heterocampa biundata* Walker in the first and third stages. Probably in these stages they are most in danger from ichneumons. Others again are furnished with tooth-like prominences on the back, as *Hyperaeschra stragula* Grote.

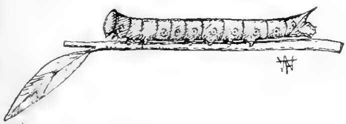


FIG. 26—Larva of *Pheosia dimidiata.* (Herrich Schaeffer.)

FIG. 27—Larva of *Schizura unicornis.* (Smith and Abbott.)

The handsome larva of *Pheosia dimidiata* Herrich-Schaeffer (Fig. 26) has a very rakish appearance. Its long body straight and trim, with its beak-shaped anal horn, is suggestive to me of an ancient galley, or an Algerine pirate boat—the conspicuous spiracles look like the openings for a bank of oars.

The green larva of *Nerice bidentata* Walker affords a fine instance of mimetic analogy. It feeds on the edges of a leaf; and its jagged dorsal-outline presents a resemblance to the leaf's serrations.

The larvae of *Symmerista albifrons* Smith and Abbot, and those of *Schizura concinna* S. and A., (Fig. 27) have gouty swellings highly colored. To gardeners the larvae of *concinna* are known as "Red-humped Caterpillars." They are sometimes very injurious to young apple trees. Where apple trees are scarce, as in the neighborhood of Quebec city, they feed on the blackberry, etc. The *albifrons* larvae are often abundant upon basswood They have the habit of hoisting the hinder parts of their bodies, and opening their claspers wide until they resemble nippers.

The larvae of *D. ministra* feed on the birch, hazel, butternut, etc. Those of *Melalopha inclusa* Hubner spin webs upon the poplars.

The four last named species are gregarious.

The caterpillars belonging to the genera Cerura and Harpyia (the moths of which are familiarly known as "Kittens") are furnished with extraor-

dinary forked and whip-like tails, which can be raised and thrown forward and agitated, as occasion requires. They are believed to be protective—their motion intimidating the ichneumons that would assail the larvae. The species have been called, on account of these tails, *Dicranuridae* (*Dikranos*, two-pointed; *oura*, a tail).

A Dicranura larva, when "full fed," forms a compact cocoon, into which it works particles of the substance to which it attaches itself. Some seasons ago, at the bottom of my insect breeding-cage, there was lying a dead pupa of a hawk-moth. A larva of the kind mentioned chose to fasten itself upon this, and to work frayings from the case into its cocoon; this, in its finished state, was apparently a mere excresence of the hawk-moth pupa.

The imagos of the Notodontidae are, generally speaking, of good size and fine appearance. The smallest of our Quebec species (as far as I know them) are: *Melanopha inclusa* Hubner, and *Gluphisia septentrionalis* Walker. The former is the "*Clostera Americana*" of Harris, and is fully described in the "Insects Injurious to Vegetation" of that author, pages 431-4. The forewings of the moth are grey, clouded with rust-red and brown. It may readily be known by the whitish V-like mark extending across the fore-wing. It expands an inch and a quarter. The latter species is a prettily marked one. The base of the fore-wing is brownish grey; then comes a band of pale grey, and then a central band of warm brown, bordered on either side with a dark brown line. In this band not far from the costa is a pale spot. Beyond the central band the wing is pale grey, clouded with darker grey, and having a wavy line of black dots near the hind margin. The insect expands an inch and two lines.

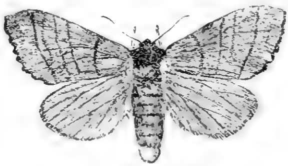


Fig. 28—Datana ministra.

Datana ministra Drury is a fine moth. (Fig. 28.) It varies in color from reddish ochre to brown. The hind margin, in the fore-wings, is crenated. Not far from the base of the wing is a curved cross-line; and, beyond this, are three parallel cross-lines. Running from the outer angle, for a short distance, into the wing, is a curved line. *Ministra* measures two inches in expanse of wings.

Hyperaeschra stragula Grote is a handsome moth. Its fore-wings are richly colored with dark grey, brown and red. Near the hind margin is a beautiful feathery line. The hind wings are white with a touch of brown at the inner angle. The insect is an inch and five lines in expanse of wings.

To my mind the Queen of Beauty among the Notodontians is the Elegant Prominent, *Odontosia elegans* Strecker. (Fig. 29.) It measures an inch and ten lines in expanse of wings. Its fore-wings are of a soft rich dove color. From the tooth on the inner margin of the wing to the base is a patch of brick-red; and at the hind margin are two parallel, scalloped, dark lines. The hind wings are white with a purplish patch on the inner angle.

The bill-hook like curve that is seen in the inner margins of the fore-wings of several of the Notodontians is conspicuous in *O. elegans*. Other species that have the curve are:— *Hyperaeschra stragula* Grote, *Notodonta*

basitriens Walker, *Lophodonta ferruginea* Packard, *Pheosia dimidiata* Herrich-Schaeffer, *Heterocampa biundata* Walker, *Ianassa lignicolor* Walker.

Notodonta basitriens Walker is another fine insect. It is an inch and ten lines in expanse of wings. Its fore-wings are brownish-grey, with a reddish brown base outlined with brown of a darker shade. It has two transverse lines, scalloped inwardly, at about two-thirds of the length of the wing. The bases of the wings of *basitriens* are suggestive of a small moth, with outspread wings, superincumbent upon the larger one, but in reverse position.

Heterocampa pulverea Grote and Robinson, a pretty grey moth, has somewhat of the same appearance (on a more extended scale); and so has *Macrurocampa marthesia* Cramer. The prevailing colour of the last named insect is creamy white. The base of the wing is of a warm brown outlined with darker brown. Near the centre of the wing is a distinct brown oval spot. The insect is an inch and eight lines in extent of wings. *H. pulverea* is an inch and a half.

A remarkably handsome moth is *Lophodonta ferruginea* Packard. It is two inches in expanse of wings. Its prevailing tint is a rich coffee-colour. It has white and brown scalloped lines crossing the fore-wings, and a large white patch on the costa of each of these wings.

Pheosia dimidiata Herrich-Schaeffer (Fig. 30) is one of the largest of our Notodontians—it is two inches and two lines in expanse of wings. It is our Canadian "Swallow Prominent." The prevailing colour of its wings is white; but in some specimens this is tinged with brown. It has an elongated dark brown patch on the lower part of the costa, broken into by a white curved line. Along the inner margin, the fore-wing is dark brown;

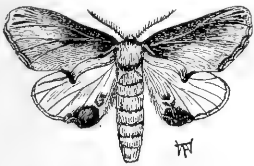


Fig. 29.—*Odontosia elegans.* (Strecker.)

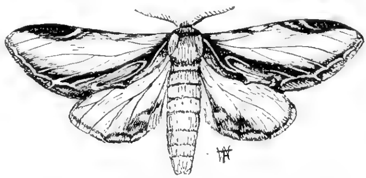


Fig. 30.—*Pheosia dimidiata.* (Herrich Schaeffer.)

and this colouring gradually fades and narrows along the hind margin till it ends at the outer angle. It is interrupted by white linear markings, one of which takes the form of a long oval. At the inner angle of the hind wing is a brown patch.

A fine moth of neat colouring is *Nadata gibbosa* Smith and Abbot. It is an inch and ten lines in expanse of wings. Its prevailing tint is ochreous, and it has a band of darker colour across the fore-wing, narrowing towards the inner margin. Within this band, not far from the costa, are twin white spots, small but distinct. *Gibbosa* bears a remarkable projecting crest on its thorax.

Nerice bidentata Walker and *Symmerista albifrons* Smith and Abbot are well known moths. In the former, the brown and grey of the fore-wings in striking contrast—the brown having two tooth-like projections—in the latter the conspicuous white border to the lower half of the costa are features that are easily recognizable.

Dasylophia thyatiroides Walker expands an inch and eight lines. It is of a light warm brown. The hind margin, in the fore-wings, is sharply indented. On the hind margin there is an oval spot; and on the inner margin a white lunette bordered with black. Curved lines extend from this across the wing.

Heterocampa biundata Walker is a handsome ample-winged moth. It is grey with an olive tint, and is marked with wavy lines. The hindmost of these presents a dotted appearance. The moth expands about two inches.

Heterocampa manteo Doubleday and *Heterocampa guttivitta* Walker are moths difficult to describe for general readers. Their tints are blended grey and brown and they have numerous dotted lines across the wings. The expanse of wings of *manteo* is an inch and seven lines; that of *guttivitta* is an inch and a half. *Manteo* has dark brown serrations on the hind margins of both primaries and secondaries. *Guttivitta* has a band across the primaries, feather like, with a large brown dot in each curve of the band.

Ianassa lignicolor Walker is an insect of trim and neat appearance. Its fore-wings are whitish grey darkened towards the hind margin. The fore-wings have a somewhat striated appearance. Across the middle of each of them is a confused brownish band, and beyond it is a second less distinct. The hind margins of these wings are crenated. The moth expands an inch and three-quarters.

Schizura concinna Smith and Abbot is the moth that comes from the "Red-Humped Caterpillar." It is of a rather insignificant appearance. Its fore-wings are reddish-brown, its hind wings grey, with a white border. It is an inch and five lines in expanse of wings. *Scizura semirufescens* Walker is somewhat larger than *concinna*, but in no way more attractive.

Scizura unicornis Smith and Abbot is easily recognized from its habit of wrapping its wings around its body, and raising itself at an angle from its support, so that it looks like a leafless twig. Its fore-wings are richly variegated with grey, brown, red and yellow, and have numerous cross-markings. The species measures an inch and four lines in expanse of wings.

The moths called the "Kittens" come next in order.

In Packard's "Forest Insects," page 566, Riley's cut of *Cerura multiscripta* Riley is given. The insect has white fore-wings prettily marked with transverse black lines. I have one specimen taken at Cowansville long ago.

Harpyia borealis Boisduval is a pretty moth with pale grey fore-wings, crossed with a band of dark grey outlined with black. It has, near the hind margin, a dark grey patch extending from the costa half way across the wing. Both fore and hind wings are conspicuously dotted along the hind margins with black.

Harpyia cinerea Walker is a plainer insect than *borealis*. It has dark grey fore-wings and white hind wings; both bordered with black dots on the hind margins, as in the case of *borealis*.

In *Harpyia scolopendrina* Boisduval the cross band takes the outline of an hour-glass.

Usually the "kittens" are about an inch and four lines in expanse of wings. The larvae of all the species are found upon willows.

I have no doubt there are other kinds of Notodontidae to be found in Quebec Province, but I have not been so fortunate as to meet them. The study of this interesting family of insects will repay the Entomologist for his time and attention in the gratification it will afford him.

THE LOCUST MITE.

By T. D. Jarvis, Ontario Agricultural College, Guelph.

During the past summer the Locust Mite (*Trombidium locustarum*, Riley) has been very common at Guelph, especially on the Red-legged Locust (*Melanoplus femur-rubrum*), but a few specimens have also been found upon the Two-striped Locust (*Melanoplus bivittatus*). The mite is most generally found attached to the base of the second pair of wings, although it is also found on the wing itself, and on any other part of the body where it cannot be readily detached by the locust; a favourite position upon the body is between the segments of the thorax and abdomen, and also behind the upper joints of the legs: in such positions their only means of attachment to their host is apparently by their mandibles.

The young mites are nearly spherical, and look very much like the eggs of insects (Fig. 32, *b*). The mite sucks the blood of its host until it reaches maturity, during which time it often becomes so swollen with food that its legs are rendered very inconspicuous (Fig. 31, *a*). As many as five of these young larvae have been found upon a single locust.

The adult mite is of a bright crimson color and about one-eighth of an inch long (Fig. 31, *c*, *d*). When full-grown it passes to the ground, where it remains over winter. Dr. Riley, who has studied the life-history of this mite, states that the eggs are laid an inch or so under the ground in clusters containing between 200 and 400. Early in the spring from these eggs emerge the young mites, which, upon reaching the surface of the ground, attach themselves to their hosts. These little mites render good service in checking the spread of the locusts, as almost every locust upon which one is found appears to be more feeble and sickly than those which have not been attacked.

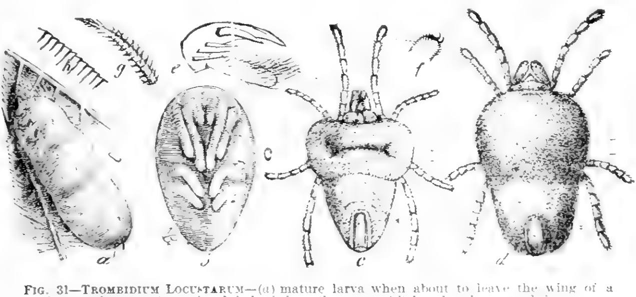


Fig. 31—Trombidium Locustarum—(*a*) mature larva when about to leave the wing of a locust; (*b*) pupa; (*c*) male adult fresh from the pupa; (*d*) female—the natural sizes are indicated by the short lines on the right (*e*) palpal claw and thumb (*f*) pedal claws; (*g*) barbed hair; (*h*) the striations on larval skin (after Riley.)

THE OYSTER-SHELL BARK LOUSE.

By T. D. Jarvis, Ontario Agricultural College, Guelph.

The purpose of this article is to place before the fruit-growers and all interested in practical entomology, the main facts regarding the life-history, habits and appearance of the Oyster-shell Bark Louse Scale, and of the scales which are often mistaken for it. The damage done by this scale of late

years has attracted so much attention, and so many enquiries have been received concerning the best methods for its eradication, that it is hoped earnest efforts will be made at once by all concerned to get it under control.

The Oyster-shell Bark-louse (*Mytilaspis pomorum or Lepidosaphes ulmi* Linn, as it is now called) is widely scattered throughout the orchards of Ontario, and the damage done by it is very considerable over the Province and rapidly on the increase.

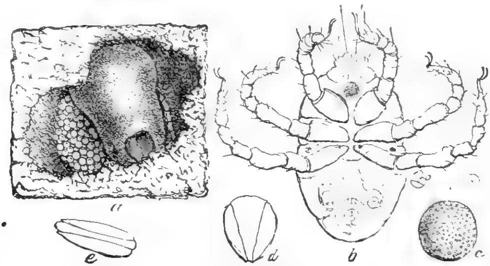


FIG. 32—TROMBIDIUM LOCUSTARUM—(*a*) female with her hatch of eggs: (*b*) newly-hatched larva—natural size shown by the dot in a circle on the right; (*c*) egg; (*d*, *e*) empty eggs-shells (after Riley.)

Although of European origin, it has been known in America for more than a century, and has gradually spread throughout the larger portion of North America.

This scale is a very serious pest in orchards which are neglected and badly treated, but experience has shown that with careful treatment it can be readily kept in check. It has been found to occur on the following trees and shrubs: Apple, plum, pear, wild red cherry, grape, currant, rose, maple, poplar, ash, birch, and various others.

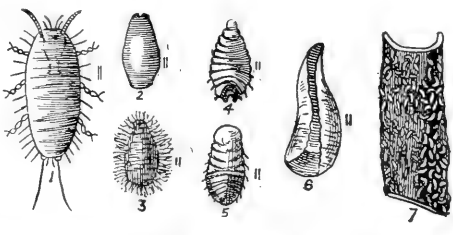


FIG. 33—The Oyster-sheil Bark-louse.

In order to combat this scale, it is first absolutely necessary that one should be well acquainted with its life-history.

Life-history.—This minute insect, found upon the bark of the small twigs and also upon the branches and trunks of the above-mentioned trees, is readily identified by its oyster-shell-shaped scale, about one-sixth of an inch in length. It is of a brown colour, and, thus disguised by the bark, is not seen unless by close observation. Usually a good many are clustered together, and their shape is so marked that orchardmen should soon recog-

nize them. These scales sometimes cover twigs and large branches completely; even the leaves are often infested, and sometimes the fruit itself becomes more or less covered. Last year the fruit on several Maiden's Blush apple trees grown in the orchard of the O. A. C. was noticed to be affected by the scale. This, however, is the exception rather than the rule.

The insect is one-brooded, and winters over in the egg stage. The eggs can be easily seen if at any time in the fall or winter the old scales be lifted up and examined beneath. Numbers of very small whitish-yellow eggs will be seen. Here beneath this oyster-shaped scale they remain until early in the summer. The young yellow lice escape from the eggs during the last week in May and the first week in June; that is, in the vicinity of Guelph. They

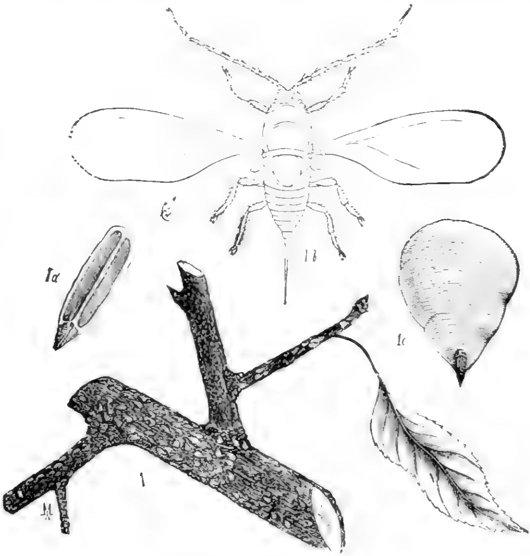


FIG. 34—The Scurfy Bark-louse.

wander for a few hours, or a few days, on the limb, then settle down and secrete a scale. They fix themselves upon the tender bark, which they pierce with the beak-like structures connected with their mouths, and by means of which they are able to suck the sap from the tree. The larvae moult, or shed their skins, twice in the course of their growth during the summer. These moults can be readily seen on the narrow end of the large scale. The adult female dies soon after the laying of the eggs, about 60 in number, in the fall. They may be spread from tree to tree to some extent by birds, and also by other insects.

Such is the life-history of the Oyster-shell Bark-louse, and before entering into a discussion as to the best means to adopt for its eradication, it will be as well to briefly mention and describe one or two other species of the commonly-occurring scales which most closely resemble it, and to point out the differences for this purpose cuts are given with the various scales.

The Scurfy Bark Louse (Chionaspis furfurus).—The Scurfy Bark-louse is not so widely distributed through Ontario as the Oyster-shell Bark-louse, and does less damage. It occurs most commonly on pear, apple, gooseberry, and black currant. This scale resembles the Oyster-shell Bark-louse closely in shape and size, the main points in which they differ being in the colour of the eggs and in the adult scale.

The eggs of the Scurfy Bark-louse are of a purplish colour, whilst those of the Oyster-shell are a whitish-yellow. The adult scale of the Scurfy Scale is also white in colour. The female scale is much larger and more oval than the male scale.

The same remedies may be employed against the Scurfy Bark-louse as are advised in this article as being most suitable for the Oyster-shell Bark-louse.

San Jose Scale (Aspidiotus perniciosus).—The San Jose Scale is readily distinguished by the characteristic shape of the female scales. They are round and nearly white, with generally a clearly-defined central nipple. After the first moult the scales become almost black, with a conspicuous depressed ring around the nipple. The adult male scale is oblong in outline, with the nipple near one end, and is much smaller than the female:

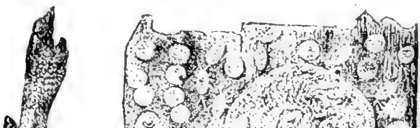


FIG. 35—San Jose Scale.

The following points will clearly separate the San Jose Scale from the Oyster-shell Bark-louse and the Scurfy Scale:

First: The arrangement or grouping of San Jose Scales on the bark is generally characteristic, and is often sufficient to at once identify them.

They seldom have a tendency to cluster, if there be few in number, but, instead, are scattered somewhat evenly on the bark.

On badly-infested trees the presence of the scale on new growths and the fruit produces a deep-red coloration on the tissues of the bark.

It leaves no conspicuous, ventral, whitish scale on the bark after the removal of the insect, as does the Scurfy Bark-louse.

The reason for considerably more damage being done by the San Jose Scale than by the Oyster-shell Bark-louse is on account of the San Jose Scale producing many broods in one season, and also bringing forth its young alive, whereas the Oyster-shell Bark-louse is one-brooded and winters over in the egg stage.

The treatment to be adopted for nearly all the scales is practically the same in all cases. On deciduous trees, where the scales remain during the winter upon trunks and branches, and where the trees become dormant, the scales are best treated during the winter. At that time there is no foliage to interfere, and much stronger washes can be used than would be possible during the summer, or when the tree is active. It is extremely difficult to penetrate insect tissues with ordinary liquids, and it has been found impossible in practice to obtain good results in the destruction of scale insects, except by means of caustics. The common soaps are all caustic, and, when applied in strong solutions, the scale is shrivelled, lifted, and partially corroded, so that the oily mixture works its way beneath into absolute contact with the insect. Or it is raised at the edges and washed off by the rains, carrying with it either eggs or young, as the case may be. In fact, where the eggs hibernate, winter applications act only by exposing them, so that they are easily washed away by rains and scattered.

In the case of plants which do not lose their foliage at any period, or in conservatories, or where winter treatment for any reason is not feasible, we must attack the insects when the larvae are crawling about, and before they are fixed. At that time, whilst not protected by a scale, they may be easily killed, almost any of the contact insecticides being effective.

Remedies.—Owing to the large number of applicants who were desirous of obtaining information on the best methods of combating the Oyster-shell Bark-louse, it was decided to carry on a number of experiments here, to test the efficiency of the various insecticides commonly used against scale insects.

Of all the spray mixtures tried, the well-known lime, salt and sulphur wash gave the best results.

The lime, sulphur and caustic soda, and the lime, sulphur and sal soda were also tried, but without quite such good results. The lime, sulphur and caustic soda proved to be a little superior to the lime, sulphur and sal soda, owing to its apparent power of better penetration.

Soaps.—Various soaps were also tried, and of these the Whale-oil Soap Emulsion gave the best results, many of the scales being killed.

The Whale-oil Soap gave good results also, but not equal to the Emulsion.

Sunlight and Lifebuoy soaps, and also a mixture of both, proved to be of very little value, inasmuch as they did not prevent the eggs from hatching. These soaps are claimed by the makers to be most effective against the San Jose and other scale insects, but applied as a winter wash against the Bark-louse they have little value. Undoubtedly they should be applied after the young lice hatch, and not as a winter application, and then would most likely prove effective against the tender lice.

Kerosese Emulsion.—Kerosene Emulsion was also tried, and this proved of more value than the Whale-oil Soap Emulsion, but not so effective as the lime, salt and sulphur wash.

Lime. Quick slaked lime, 1½ lbs. to 1 gallon of water, proved very effective applied as a winter wash, and equalled the results obtained by the lime, salt and sulphur.

Kerosene-Lime.—This was also tried, but did not prove superior to the Kerosene Emulsion, and therefore is not to be preferred to it.

The lime-sulphur sprays must not be applied while the trees are in foliage, first, because of the disastrous results that follow when this is done before the leaves have matured; and secondly, becaue of the difficulty in making a thorough treatment at such a time. The month of March and the early part of April, before the buds commence to open, is a good time to spray with these mixtures.

THE BEAN WEEVIL (*Bruchus obtectus*, Say).

By Arthur Gibson, Assistant Entomologist, Central Experimental Farm, Ottawa.

An insect which, fortunately, has only been reported on a few occasions as doing damage in Canada, is the Bean Weevil, *Bruchus obtectus*, Say. Authentic instances of injury by this insect have been received from one locality in Ontario, and from two in Quebec. The injury in all cases was to seed beans.

The Bean Weevil (Fig. 36) is a small, hard-shelled beetle, one-tenth of an inch long, oval in form, with the head bent down and more or less concealed, as seen from above, and prolonged into a squarely-cut snout, or beak. Its antennae are distinctly jointed and enlarged at the tip, the first four joints and the last one reddish. The wing-covers are marked with ten impressed and dotted longitudinal lines, and the whole body is covered with long, silky hairs. The lines on the wing covers are broken up into pale yellowish dashes and dark brown spots. The tip of the abdomen extends beyond the wing-covers, and is of the same reddish tinge as the tips of the antennae and the legs, but is covered more or less with short, silky hairs, and bears a central white line, but there is no appearance of the two black spots so conspicuous in the Pea Weevil, which it resembles in shape and movements. Compared more closely with this latter well-known inect, the Bean Weevil is not one-half so large, is more soberly colored, having less white on the wing-covers, and lacks the white spot on the middle of the

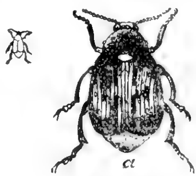


Fig. 36—The Bean Weevil.

hinder part of the thorax, and the two black spots mentioned above, which are present on the exposed tip of the abdomen of the Pea Weevil.

"The life-history of the Bean Weevil differs in some important points from that of the Pea Weevil. The eggs of both are laid upon the pods while these are young and tender. On hatching, the young grub of the Bean Weevil eats its way inside and penetrates one of the forming beans, several grubs entering a single bean, each one forming for itself a distinct cell. They become full-grown, and change to pupae in the autumn, and a little later to the perfect beetles. The date of emergence from the seed depends very much, as in the case of the Pea Weevil, on the temperature in the autumn months; it may be in the late autumn or not until next spring; when the seed beans are stored in a warm building, the beetles may emerge at any time through the winter. One of the important differences between the life-histories of the Pea and Bean Weevils is that, whereas in the case of the former the young grubs can only enter the soft green seeds, those of the Bean Weevil can propagate for three or four generations in the dry stored seeds. This fact renders the well-known domestic remedy for the Pea Weevil, of holding the seed over for two years, quite ineffective in the case of the Bean Weevil; that is, if the bag of peas infested with the Pea Weevil were put away for two years, the Pea Weevils would emerge the first spring and die in the bags. But in the case of a bag of beans infested by the Bean Weevil kept in the same way, the beetles on emerging would at once set to work to lay eggs on the beans. The young grubs when hatched would penetrate the dry seeds and go through all their stages, and this breeding might be repeated as long as the supply of beans lasted. Curiously enough, the Pea Weevil does not bore holes through the paper or cotton bags in which infested seed has been stored, but in the case of the Bean Weevil, such bags are readily perforated and the beetles escape,—frequently when this happens in houses, as is sometimes the case, to the great consternation of the inhabitants." (Fletcher, Bull. 52, Cent. Exp. Farm, Ottawa.)

In the United States the Bean Weevil has been known for a great many years. It was found injuring beans in America in 1860, near Providence, Rhode Island. Since then it has become wide-spread in distribution in that country, and has done a considerable amount of damage. At first it was considered to be a native species, but it is now thought that the original home of the insect was in Asia, and that it was introduced into America through commerce. The first record of injury done by the Bean Weevil in Canada was in 1898, in Middlesex County, Ontario, and since then two further instances of loss from the ravages of this insect have been reported from Quebec Province. Quite recently the writer heard of the presence of the Bean Weevil at Guelph, Ont., in beans imported for seed from the United States. (It has also been reported from Aurora, Ont.—C.J.S.B.)

The Bean Weevil shown herewith is only about half the size of the Pea Weevil, but resembles it in general appearance. The best remedy for both of these insects is bisulphide of carbon. The most convenient way to fumigate is to place the seed in an ordinary coal-oil barrel, and pour on it one ounce of the bisulphide of carbon for every 100 lbs. of grain, then close the barrel tightly, first with a wet canvas or cloth, and on the top of this boards, which should be left undisturbed for at least two days.

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G

THIRTY-EIGHTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO

1907

PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.

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TORONTO.

To the Honourable Sir William Mortimer Clark, K.C.,

Lieutenant-Governor of the Province of Ontario.

May it please your Honour:

I have the pleasure to present herewith for the consideration of your Honour the Report of the Entomological Society for 1907.

Respectfully submitted,

NELSON MONTEITH,

Minister of Agriculture.

Toronto, 1908.

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THIRTY-EIGHTH ANNUAL REPORT

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1907.

To the Honourable Nelson Monteith, Minister of Agriculture:

SIR,—I have the honour to present herewith the Thirty-eighth Annual Report of the Entomological Society of Ontario, which contains the proceedings of the Forty-fourth Annual Meeting of the Society. A full account is given of the discussions upon fruit-tree insects that took place, the papers that were read and the reports of the various Officers, and Branches of the Society. Since the removal of its headquarters to Guelph and its more intimate connection with the Ontario Agricultural College, its activities have been increased and its work carried on with much enthusiasm and success.

The Canadian Entomologist, the monthly magazine of the Society, has been regularly issued during the year and has now completed its thirty-ninth annual volume. Its high scientific character has been steadily maintained.

I have the honour to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,
Editor.

Ontario Agricultural College,
Guelph.

Entomological Society of Ontario.

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LIFE MEMBER.

Saunders, Dr. William........Ottawa.
Director of the Experimental Farms of the Dominion.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

ANNUAL MEETING.

The forty-fourth annual meeting of the Society was held in the Biological Building of the Ontario Agricultural College, Guelph, on Thursday, October 31st, and Friday November 1st. The chair was taken by the President, Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms. Among those present were Rev. Dr. Fyles, Levis, P.Q.; Mr. Henry H. Lyman, Montreal; Mr. Arthur Gibson, Central Experimental Farm; and Mr. C. H. Young, Ottawa; Dr. Brodie, Dr. E. M. Walker, Mr. J. B. Williams and Mr. C. W. Nash, Toronto; Mr. J. F. Calvert, Orangeville; Professors Hutt, McCready and Bethune, Messrs. Jarvis, Eastham, Howitt, Zavitz, Crow, Klinck, and a number of students of the Ontario Agricultural College; Mr. Howes, Principal of the Consolidated School, Mr. Graesser and others, Guelph.

Letters expressing regret at their inability to be present were received from Mr. C. C. James, Deputy Minister of Agriculture for Ontario; Mr. W. H. Harrington, Ottawa; Mr. G. E. Fisher, Burlington; Prof. Dearness and Messrs. W. E. Saunders and J. A. Balkwill, London; Mr. J. Fred. Smith, San Jose Scale Inspector for Ontario; Mr. Walter James Brown, Editor of the *Weekly Globe and Canada Farmer*, Toronto; Mr. A. McNeill, Chief of the Fruit Division, Department of Agriculture, Ottawa; Mr. P. W. Hodgetts, Secretary of the Fruit Growers' Association, and others.

THE ENTOMOLOGICAL OUTLOOK.

[*The Annual Address of the President.*]

By Dr. James Fletcher, Dominion Entomologist, Ottawa.

Ladies and Gentlemen: It is with feelings of pleasure and pride that I welcome you and invite all present to take part in the Forty-fourth Annual Meeting of the Entomological Society of Ontario. During its long and useful life, this organization through its efficient officers, has made a constant and consistent endeavour to render its efforts not only useful to the Province in which it has held an official position as an intregal part of the Department of Agriculture, but also effective in advancing the scientific development of the science of entomology. Under the patronage and with the expressed sympathy and encouragement of the Minister of Agriculture and our highly esteemed Deputy Minister of Agriculture, our society has from the beginning until the present time continued to grow in usefulness and public appreciation among those for whom our efforts have been made. It is not now necessary to draw attention individually to the many stalwart men who have served on the councils, everyone of whom has been of great value to the society in adding to its stability, dignity, and usefulness; in building up its reference collections and magnificent library; in solving the various

problems which have arisen with the sudden appearance in destructive numbers of many injurious insect pests; and also in presenting to the public in its publications, the *Canadian Entomologist* and the Annual Reports, a vast amount of valuable knowledge, by which science has been enriched and enormous sums of money have been saved to Canada at a disaproportionately small expenditure. All of this has been done at the cost of much self sacrifice, but quietly and without ostentation. In this good work, this great work, there are, however, two names which I cannot refrain from mentioning, William Saunders and Charles J. S. Bethune. These two men to whom we owe so much, were associated together in founding the society, and from that time to the present day have been, with their energy, patience, discretion and unfailing courtesy, main stays of its progress and healthy growth. Without undue glorification, it is well that our members should recollect the long period over which this work of unbroken activity has extended; and it behoves us to see well to it that, as members of such a worthy society, our very best efforts are put forth in all the work we do, to take the fullest advantage of the greater facilities we enjoy to-day over those who have preceded us in our chosen field. Let us never forget the debt we owe to the pioneers of science. The results of the dearly bought experience of the past form a solid foundation of fact upon which we now stand firmly and confidently, to enter upon new fields of investigation. The status of entomological research to-day is far different from what it was even ten years ago. The number of devotees to these attractive studies is easily a hundredfold greater than then. The same may be said of almost every aspect of the case:—the available works of reference, the greater facilities and decreased cost of communicating with others, of local or distant travel, and, above all, the spirit of helpfulness to others less informed than themselves, so conspicuously exhibited by specialists in every branch of scientific study.

We in Canada can never over-estimate what we owe to the generosity and ever-ready assistance of the eminent fellow-workers in the great republic to the south of our borders, who have made America the chief fountain head and acknowledged centre of applied entomolgy. The names of such men as Riley, Walsh, Lintner, Howard, Comstock, Forbes, Webster, Smith, Marlatt, Felt and a host of others too numerous to mention, are known and honoured the whole world over, but nowhere more sincerely than in Canada, where we owe so much to them. As we all know, it is very seldom that an outbreak of any serious pest occurs in any part of the Dominion, but we can at once by consulting the writings of these men, learn all that is known of the habits of the insect and what the experience of many students has shown to be the best means of dealing with it. In entomolgy, at any rate, whether purely scientific or applied to the industries of the nation, there is no recognition of international boundary lines, unless perhaps it may be as an excuse for extending exceptional courtesies. Canadians are welcomed as freely at all the great conferences in the United States and have as full privileges of membership open to them as though they were freeborn citizens of the Union. At the recent organization of the Entomological Society of America, the most important entomological society in the world, two of the officers of this society were elected as original fellows and placed on the council, one of them being made a Vice-President. Since then two more members of our Council have been elected to fellowships, a highly coveted honour.

On the other hand, I need not remind you of the inspiring visits and addresses we have been favoured with at our recent annual meetings by Dr. Howard, Prof. Webster, Dr. Smith, Prof. Wickham, Dr. Skinner and our

honoured guest of the present meeting, Mr. A. H. Kirkland, who will explain to us the remarkable work which is being carried on under his superintendence against the Gypsy and Browntail moths in the State of Massachusetts.

It has long been a matter of surprise, even more than that, of amazement, to those who understand the enormous losses caused by insects to every class of vegetable products, that the study which deals with these powerful enemies and from which all remedies must emanate, should be so lightly esteemed by the general public. That this—may we call it, age of darkness and ignorance?—is now passing away, is evidenced by the important international investigations which are being carried on by Governments in all parts of the world at apparently enormous expenditure. I say "apparently," because the good results obtained so far outweigh in magnitude all the cost of securing them, that this latter must be considered trifling by comparison. One needs but to think of the immense saving which has been effected in checking or controlling some of the better known extensive invasions of insects. The prompt application of practical remedies could only be made where scientific investigations both of the life-histories and of the most appropriate remedies had already cleared the way and had pointed out what must be the road to success.

The large expenditures authorized by Governments from time to time for the purpose of investigating the habits of, and fighting against, injurious insects, have to some measure opened the eyes of the world to the important role played by insects as affecting the general welfare, and the necessity of dealing with them promptly and vigorously. Grasshopper invasions have in the past caused widespread devastation of fertile lands; but, with a knowledge of the egg-laying habits and with modified agricultural treatment of the land based on this knowledge, such losses can be to a large measure controlled. The San José Scale, although confined to only one comparatively small area in Ontario, and to two isolated points in British Columbia, has been the cause of considerable loss in the orchards of the Niagara Peninsula and also of much anxiety to Governments and fruit growers of the whole Dominion. From the vast amount of experimental work of many students here and in the United States, a practical remedy has been discovered in the lime-sulphur wash. The San José Scale has called for the voting of large sums of money in Canada and in almost every State of the Union; and, although, as stated, a practical remedy has now been found, it is probable that for all time fruit growers, in those districts where that insect thrives, will every year have to take steps to control it. This, however, it must be remembered, is not because the remedy is not all-sufficient, but, because, even against this well understood and justly dreaded enemy, so many fruit growers do not take the necessary steps or even ordinary precautions to control it. Perhaps the best known and most convincing instance of a large expenditure of this nature, is that for the campaign which has been waged against the Gypsy and Browntail moths in the State of Massachusetts. Up to the year 1900 a great deal of money had been spent against the former of these, and it had been almost vanquished, when, for political reasons, the appropriations were most unfortunately stopped. This was, it can now be seen, a most deplorable mistake; for during the following five years nothing was done, and the whole of the area previously infested was again overrun and fresh territory was invaded. The necessary appropriations up to the present time have now reached the sum of about two million dollars, and the Federal Government has had to step in and help. Although wonders have been achieved by Mr. Kirkland and his associates,

the end is by no means in sight. The thorough work done by Mr. Kirkland and Dr. Howard in connection with the introduction of parasites from Europe are an object lesson to the whole scientific world.

Dr. Howard, when speaking as president of the section of Economic Zoology, at the great international Congress of Zoologists held at Boston in August last, referred to this work in the New England States as being the most extensive campaign in economic entomology that the world has ever seen. He commended most highly the practical and efficient way in which it had been conducted, justly giving credit to Mr. Kirkland for his great executive ability and discretion in dealing successfully with a most difficult problem.

Another campaign calling for enormous sums of money and the greatest scientific skill, on the part of those engaged in the warfare, was made necessary by the spread of the Cotton Boll Weevil from Mexico into the United States. The extent of the damage done by this insect can hardly be believed by those who have not studied the matter; but in some seasons of great abundance the loss in a single year has been estimated at twenty-five millions of dollars, and it is said that the weevil is gradually spreading farther through the Southern States every year.

The Hessian Fly, the Wheat Midge, the Chinch Bug, and recently the Grain Aphis have all been the cause of great losses to the countries where they have occurred; but it is now generally recognized that, with these insects, as with nearly all others, farmers, fruit growers and gardeners can get from expert students of insect life useful information as to improved agricultural methods and as to tested remedies, by which much of the loss may be prevented. The publication of popular reports by provincial, state and federal governments has familiarized many with the appearance of their worst insect enemies; and the introduction of the so-called Nature Study into schools has taught a large number of the fathers and mothers of school boys and girls throughout the country, as well as the scholars themselves, that it is worth the while of every one to know something about the common insects which they see about them every day.

Characters which among others render insects particularly useful in Nature Study and in the higher exercises of animal biology, are, the large numbers of common species which are always accessible; their convenient size; the ease with which many kinds can be kept alive and reared in confinement to almost any required number, so that their habits can be studied under varying conditions; and the general similarity of a large number of specimens of a given species, and yet, at the same time, the wide range of certain features of variation within the limits of a single species. One of the greatest drawbacks to the use of insects, particularly in a school where there is no regular museum, is the perishable nature of specimens, if it should be desirable to preserve them. This, however, takes them out of the proper field of Nature Study, into natural history pure and simple, where provision must be made for the preservation of specimens so that they may be available whenever required for study and comparison.

The remarkable discoveries which signalized the close of the last century, as to the conveyance of many diseases through the medium of common insects, *e.g.*, malaria, yellow fever, typhoid, the bubonic plague and other diseases of mankind, and also of Texas fever and other diseases of domestic animals, have opened up another field of useful investigation which has inseparably linked together entomology and medical science.

During the past summer subsequent to our summer meeting, I had the privilege of travelling through our Northwestern Provinces with Dr. Henry

Skinner and listening to a series of lectures given by him upon the transmission of disease by insects. These lectures evoked the keenest interest from the large audiences who heard them, and there were many expressions of surprise at the intimate relation which was shown between the prevalence of some diseases and the occurrence of such common insects as house flies, fever mosquitoes, bed bugs, fleas, ticks, etc.

In this connection we, as Canadians, must read with great pride the accounts of the excellent work which is being done by Dr. Todd, of Victoria, B.C., and Dr. Allan Kinghorn, of Toronto, in connection with the School of Tropical Medicine, at Liverpool, England. The last named is now in Africa, on an expedition to the Zambesi, having been specially selected to investigate the fatal sleeping sickness and allied diseases, which are conveyed by insects. No less noteworthy are the investigations of animal diseases, which are being carried on by Drs. Higgins, Hadwen and Watson, under Dr. Rutherford, the Veterinary Inspector General of the Dominion.

From a consideration of the facts above cited I cannot but feel that the outlook for entomology and for entomologists is brighter than it has been for many years. The study of insects is now recognized as a useful branch of knowledge which affects materially the prosperity, comfort and health of mankind. This is attested by its introduction into the curricula of many colleges and schools and the appointment of Professors to instruct those who desire to learn about insects.

In Canada we have many good workers connected with our Society, or working alone, who are year by year adding to the mass of scientific knowledge concerning Canadian insects. This knowledge is increasing rapidly and is being placed on record for future use. Our society contains in its membership a large number of enthusiasts, and I am pleased to know that the publication of the annual Entomological Record in our reports has to some measure fulfilled its designed object, in encouraging and bringing into communication with each other and with specialists, many scattered workers in distant parts of Canada, who, by learning what others were doing, were enabled to be mutually helpful to each other.

As indisputable evidence of the value of this knowledge, it was pointed out by the Editor of the *Canadian Entomologist* in the issue for May last, that the Government of the United States, (of perhaps the most practical people in the world) passed appropriations for entomological purposes for the fiscal year ending June 30th, 1908, of upwards of $650,000, made up as follows:

For Bureau of Entomology, Washington..............	$136,000 00
Emergency appropriations:	
Cotton Boll Weevil investigations	190,000 00
Prevention of spread of Gypsy and Brown-tail Moths..	150,000 00
Eradication of Cattle Ticks	150,000 00
	$626,000 00

and, in addition to this, part of another appropriation of $250,000 for the National Museum is devoted to the care of the insect collections, in which work several officers are permanently employed. A proportion of another vote is used for the printing of bulletins, special reports, etc. These objects will certainly take at least another $24,000, making a gross amount of about $650,000, appropriated in a single year to study and fight insects.

Now, this large expenditure is only justifiable because it is believed that commensurate benefits are received in return. This brings me to the last

part of my subject, which I think is of keen personal interest to many present here to-day. If any of you, and doubtless there are some, think of making a serious study of entomology, that is to take it up as your life's work, there are several things which must be considered very carefully. The first, undoubtedly, is, Are you so keenly interested in the work as to enable you to excel? This is no easy matter. In the first stage of study, everything examined is strange, attractive and interesting; but then comes a long stage of close patient study and hard work, which love for the subject alone can carry you through. After this comes the reward in the shape of the delight of making new discoveries and learning more and more of the underlying principles of the science in all its branches, so that, when occasion arises, you may be able to take advantage of favourable opportunities for securing remunerative work. Moderate attainments are of little value in making a living. To be successful you must be, at any rate, just a little better than your fellows. Success must always depend on excellence; and, to attain this, thoughtful consideration and methodical application are as necessary as patience and hard work. All work undertaken should be done as well as possible, for your own sakes and for the work's sake. I believe it should be a principle with everybody never to strive for what is called "credit". Credit can never be gained by direct attack or by self-advertising. Fame which is the same thing, is a fickle godess who comes unsought and, if dragged in against her will, is in such a sulky mood that she is not worth having. Good thorough work will always demand and will always receive recognition. Strive to have your work as perfect in every detail and as conclusive as you can render it; and, above all things, aim to avoid the rocks and whirlpools of unproved theory.

Owing to the rapid development of economic entomology, new openings are being constantly created; and, as a consequence, there will be keen competition among the whole army of young men now training themselves to compete for these prizes. I know that there are openings to-day for well-grounded and mentally well-equipped entomologists. The demand for such men is increasing, and in the near future there will be further opportunities in many lines of work which to-day are not dreamed of. The best prepared will naturally gain the greatest prizes. The one desideratum is efficiency. A knowledge of insects alone is not sufficient to make an efficient practical entomologist. There are many necessary factors for such an official; for instance, he must be an enthusiast and should not only possess a general knowledge of all the different order of insects, but should have a special knowledge of some one or more; he should be well grounded in the elements of animal life and plant life and must have at least a working knowledge of the first principles of agriculture and horticulture, besides being fairly familiar with the botany of the locality where he does most of his work. A good knowledge of the English language is also most essential, so as to acquire a habit of expressing simply and clearly but in a succinct manner whatever information it may be necessary to communicate to the public.

Those of you who are in attendance at this well organized College, have special advantages of an exceptional nature, of which you should use every endeavour to avail yourselves to the fullest possible extent. You have Professors thoroughly qualified and eminent in their own subjects. In your Professor of Entomology especially, you have a man who perhaps has done more in Canada than anyone else to build up and establish on a firm basis the science which we have met here to-day to discuss, a man who, so capable in teaching, is also so genial and courteous that it is always a pleasure to meet him and a delight to be associated with him. You have around you extensive and beautiful grounds in which you can study insects and the

plants with which they are associated, as well as birds and other members of the animal kingdom. You have a comfortable, convenient and well equipped museum, and also the use of the extensive collections and valuable library of our Society. With such opportunities what should you not achieve? The College you are attending, is in many ways the very best of its kind in America or in the world. Think of this and remember it. It is an easy matter for the men gathered together under its shadow to honour their alma mater. May it be always their highest ambition to honour her and to be an honour to her.

CONFERENCE ON FRUIT-TREE INSECTS.

The main pests discussed were the Fruit-tree Bark Beetle or Shot-hole Borer, the Codling-worm, the Oyster-shell Scale and the Woolly Aphis.

Mr. L. Caesar, of the Ontario Agricultural College, opened the discussion on the first named insect by relating some observations he had made on its ravages in the Niagara district. His account was as follows:

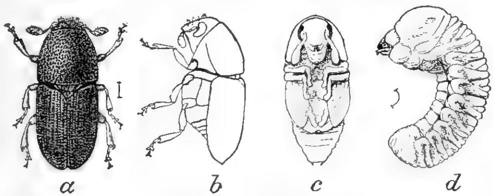

Fig. 1.—*Scolytus rugulosus*: *a*, adult beetle; *b*, same in profile; *c*, pupa; *d*, larva—all magnified about 10 times. (U. S. Dep't. of Agriculture).

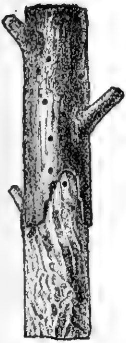

Fig. 2.—Work of *Scolytus rugulosus* in twig of apple—natural size. (U. S. Dep't. of Agriculture).

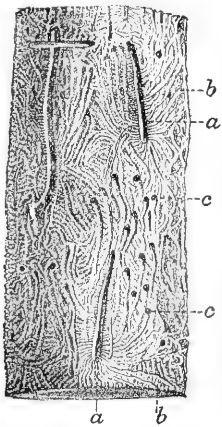

Fig. 3.—Galleries of *Scolytus rugulosus* on twig under bark; *a*, *a*, main galleries; *b*, *b*, side or larval galleries; *c*, *c*, pupal cells—natural size—(after Ratzeburg, from U. S. Dep't. of Agriculture).

THE FRUIT TREE BARK BEETLE (*Scolytus rugulosus*).

In August last (1907), while acting as assistant entomologist in the temporary absence of Dr. Bethune and Mr. Jarvis, I received a letter from Mr. Geo. Olmstead, of Grimsby, asking whether I knew of a blight that attacked cherry trees. In response to a request for samples of the affected leaves and twigs, Mr. Olmstead sent me as many as he could put in a large envelope. These were examined for fungus diseases and some were also sent to the Bacteriological Department to be tested for bacteria. No fungus or bacteria were discovered to be present. Accordingly I wrote to Mr. Olmstead and told him that I should be making a tour of the Niagara district in a few weeks to investigate the results of the lime-sulphur wash, and would call and try to discover what was the cause of the injury to his cherry trees.

On September 23rd, I went to Fruitland and in the course of my regular investigations visited many prominent fruit-growers. I asked each of these whether any of their cherry trees had shown any signs of disease. Most of them said that they had observed the leaves of some at least of their trees withering up and dying, but did not know why. On investigation we found that the trees that had been healthy last year and the early part of this year, but that were now dying, were thickly dotted in most cases with gummy exudations, varying from the size of a pea to half an inch or more in diameter. On removing the gum from a number of these places we found clear evidence that some insect had bored a tiny hole through the bark in each case and that it was from these wounds that the gum had exuded. On further investigation we found a number of the insects themselves. These I identified as Fruit-tree Bark-beetles (*Scolytus rugulosus*), Fig. 1. They were about one-tenth of an inch in length, and about one-third that amount in width, were nearly cylindrical in shape and black in color.

A number of orchards were visited in the following localities: Fruitland, Winona, Grimsby, Jordan, Vineland, and St. Catharines. In nearly all of these the beetles were found attacking not only dead and diseased trees, but also trees that had been perfectly healthy hitherto. In some orchards nearly half of the cherry trees were severely attacked, in others only a very few trees.

The attacks were not confined to any one variety of cherry tree, for both sweet and sour varieties were assailed. In one orchard, however, where Montmorency and Richmond trees were side by side, the Richmonds were much injured while the Montmorencies were left untouched

The only other tree besides the cherry on which I found the beetles were a few plum trees in the St. Catharine's district. Two of these especially were very badly covered with gum and were practically past recovery.

On examination of the habits of the beetle, it was found that they seemed in most cases to have attacked the dead or weak trees first and to have spread from these to the healthy ones. This, I find, is in accordance with the regular accounts given by different writers on the subject. In their attack upon healthy trees the beetles did not confine themselves to any set order of procedure but apparently were just as likely to assail twigs or small branches as the trunk.

On the trees where the gummy exudations were, I examined a number of the holes from which the gum had exuded, expecting to find larvæ present, but in no case did I find any. It looked as if the attacks were made with the intention of causing the tree to die and thus become a proper place for egg laying. Larvæ, however, were found in considerable numbers under the bark of dead trees. The surface of the wood in such cases, when the bark had been

removed, was engraved with numerous little channels running in different directions but not going deep into the sap-wood. (Figs. 2 and 3). It was in these channels that the larvæ (small, legless, white grubs) were found (Fig. 1 *d*), often more or less concealed by the sawdust-like castings. The holes leading through the bark of such trees into the wood were small and such as would be made by fine shot (Fig. 2); hence the beetle is often called the "Shot-hole Borer." This sort of hole on dead or almost sapless trees and the gummy exudations on healthy trees make the presence of the beetle in an orchard easy to discover. That the insects were still at work late in September was evident from the number of adults discovered and the fresh castings at some of the holes. In one of these holes I found eggs but whether laid by a beetle or some other insect I could not say. I find, however, that some writers state that the winter is passed both in the egg and larval stages. I have not been able to find a reliable account of the life-history of the insect, but it looks very much as if there were more than one brood in a season. I should have mentioned earlier that the first evidence that the cherry tree leaves were beginning to die was about August 1st.

When asked by the fruit-growers what could be done to check the beetles, I told them that the plan ordinarily recommended was to cut down all dead, dying, and badly infested trees and burn them. I said that I believed that spraying was also resorted to as a preventive, but that having had no experience with fighting this insect myself, I should bring the question up at the Annual Meeting of the Entomological Society and endeavor to discover the best method to be pursued in fighting it, and would then send full particulars to the newspapers of the different districts.

Dr. Fyles: Is it possible for such a small insect to do so much injury?

Dr. Fletcher: Yes, quite possible. We should like to know the life history of the beetle better to be able to give more definite methods of treatment. The first thing to do, however, is to cut out and burn all dead and dying trees and branches. No branches pruned from any kind of tree should be left in brush heaps to become a breeding centre. Any wash applied must necessarily be in the form of a deterrent on account of most of the insect's life being passed under the bark. Carbolic washes have given satisfaction in some places; they are applied in spring.

Mr. Caesar: The State Entomologist of Georgia thinks that lime-sulphur carefully applied in late spring should be equally good.

Dr. Fletcher: Possibly. It looks as if lime-sulphur were being considered a panacea for all ills. It is helpful in so many things that we may be expecting it to do everything for us.

Mr. Jarvis: A few of the Fruit-tree Bark-Beetles are to be found in nearly every district each year on dead fruit-trees, such as cherry or plum. Some healthy apple-trees near here which are badly infested with the Oyster-Shell Scale have been attacked.

Dr. Fletcher: It is important to know that Mr. Caesar's observations go to show that healthy trees may be attacked. It used to be thought that it was only diseased or dead trees that were infested. It is from the latter kind of trees that the beetles spread to the healthy ones. According to Webster this Scolytus follows bad attacks of the San Jose Scale; it has been very abundant at Leamington where the scale is common.

The Codling-Worm.

Mr. Caesar: I cannot help feeling particularly interested in this question of the Codling-worm. I saw its ravages in the apple orchards of the Niagara district last year and again this fall. I believe that the damage

done this year is even greater than that of last year. I visited a good many apple orchards from Fruitland to St. Catharines and I believe that fully 50 per cent. of the apples were rendered unmarketable by worms. Strange to say, comparatively few pears were injured, not more, I think, than 5 to 10 per cent. where the trees had been sprayed with poisoned Bordeaux mixture. The damage to apples, however, was most discouraging. I cannot help feeling that the farmers do not know how to deal with the pest. Some of them use poisoned Bordeaux and bandage their trees as well and yet have simply hosts of Codling-worms. It may, of course, be that the spraying is not done at the right time and that the bandages are either not properly put on, or not opened and the worms taken out so frequently and thoroughly as is necessary. Something will have to be done or else farmers will give up apple growing in that district. I know one man who will have from 8,000 to 10,000 barrels of apples this fall, but of these fully 4,000 barrels will be unfit to put on the market, simply on account of the Codling-worm.

Prof. Hutt: The Codling-worm has certainly been very bad this season in the Niagara district and the remedies applied are not sufficient. The fruit-growers do not seem to know how to fight the pest.

Mr. Jarvis: I do not think many of the farmers bandage their trees, and some who do fail to remove the bandages once every ten days as they should.

Dr. Fletcher: Great care should be taken to see that all the worms under the bandage are destroyed each time.

Mr. Caesar: This is greatly facilitated by the trees being scraped in the winter.

Dr. Bethune: Do the farmers gather up the fallen apples each day and destroy them, or sell them to cider factories?

Mr. Caesar: There are many orchards where the fallen apples are not gathered; in fact I think that in none of the orchards is this done daily.

Dr. Bethune: Could they not in some cases let their hogs or sheep run in the orchards?

Mr. Caesar: Most of the orchards are not fenced, and very few hogs or sheep are reared.

Dr. Fletcher: If the fruit-growers will spray with poisoned Bordeaux at the proper times and will put bandages on when the worms are beginning to emerge from apples, and remove these at least every tenth day and destroy the worms underneath, they will control the Codling-worm. At Ottawa we have had no Codling-worms in our orchard on the Experimental Farm for ten years because regular spraying has been done; and even in districts where there are two broods similar good results can be obtained.

Mr. Caesar: Do all the worms that fall to the ground in the apples, or otherwise, find their way up under the bands? Do not a large number hide under lumps of earth or any kind of refuse or shelter on the ground?

Dr. Fletcher: Many of course will get under the bark below the bandage, unless it has been scraped; some will hide under loose bark around the base of the tree or under boards, but I do not think any pupate under lumps of earth or among grass, at least I have never found any.

Apple growing in the Niagara district is not considered so remunerative by the fruit-growers there as the raising of peaches and other kinds of fruit, so that there has been a great deal of neglect of apple orchards, with the natural result that every opportunity has been given to the Codling-worm to increase at a very rapid rate, and even where one farmer looks after his orchard well, the neglect to do this on the part of his neighbor prevents satisfactory results being obtained.

Mr. JARVIS: I should like to call the attention of the members to the fact that the O. A. College orchard has been carefully sprayed this year at the proper time in the spring, and twice later on in the season at the usual intervals, and very few, not more than 5 per cent. of the apples are wormy. We have not a full second brood here but have about 15 per cent. of a second brood in ordinary years. A few trees on the campus that were not sprayed had almost every apple wormy. One could scarcely want clearer evidence of the value of spraying.

THE OYSTER-SHELL SCALE OR APPLE-TREE BARK LOUSE.

Prof. HUTT was asked by the chairman to open the discussion on this subject. He related his observations in different parts of the province and stated that last year had been a very favorable one for the increase and spread of this scale, and that this year he had heard many reports of its great abundance, especially in the counties of Northumberland and Ontario. He thought it was doing a great deal of injury to fruit trees, especially apple trees all over the province

A MEMBER: Are many other kinds of trees attacked by this scale besides apple trees?

Mr. JARVIS: We have found it at Guelph on apple, pear, plum and cherry trees; on currant, gooseberry, rose, spireas and lilac, and also on numerous forest and shade trees, such as mountain ash, hawthorn, red-osier, dogwood, basswood, both black and white ash, American aspen, horse-chestnut and mulberry trees.

Mr. CAESAR: I think that from what I have seen this year there will not be half the number of Oyster-shell scales next year that there were last. The scale-lice hatched out all right this June and the branches of many trees were almost covered with the young. I examined some of these same trees a few weeks ago and found that the great majority of the young scales had not lived through the season, but had died when only a few weeks old.

Dr. BETHUNE: Some experiments that have been made with lime-sulphur wash seemed to show that it is not entirely satisfactory as a remedy for this scale, though it destroys a large number of them.

Dr. FLETCHER: It is not usually considered a perfect remedy for Oyster-shell scale.

Mr. CROW: I sprayed a few trees here with the ordinary kerosene emulsion, and some others with the flour-kerosene mixture. The spraying was done just when the young had hatched out and were moving over the branches. The results were very satisfactory. I can bear out the statements made as to the prevalence of this scale throughout the province and the vast injury it is doing, but I agree with Mr. Caesar that from some cause, whether it be the late spring and cold weather after the young emerged, or whether it was owing to rains at that time, there seems to have been a very great diminution in the number of living scales this fall.

Mr. NASH: My experience makes me agree with what has been said in regard to the decrease this year in the number of scales. This spring I noticed one of my trees late in June swarming with young scales. I examined the same tree not long ago and was amazed to find scarcely a living scale on it.

Dr. FLETCHER: This is not the case in all parts of the province. I was interested in Mr. Crow's remarks about the success of the kerosene emulsion and flour-kerosene sprays. These may be considered the standard remedies against the Oyster-shell scale.

Mr. CAESAR: The orchards in the Niagara district, that two years ago were badly infested with Oyster-shell scale and were sprayed last year and again this year with lime-sulphur, seem to be quite clear of this scale.

Dr. FLETCHER: Wherever an orchard is sprayed year after year with lime-sulphur or even with Bordeaux mixture, the Oyster-shell scale gradually ceases to trouble. I have always found, moreover, that the healthier you can make your trees, the less likely are they to be badly attacked by Oyster-shell scale. Lime-sulphur helps the tree to be healthy.

Mr. CAESAR: I found that in some orchards almost 50 per cent. of the scales were parasitized by a tiny yellowish four-winged fly (a Chalcid). Mr. Jarvis and I raised a number of these parasites this spring.

Dr. FLETCHER: I have seen a case where 80 per cent. were parasitized, but I am sorry to say that the parasite does not work in all parts of the province, as it is only locally abundant.

Mr. CROW: Mr. Dempsey, of Trenton, thinks the parasite has controlled the scale in his orchard.

Mr. JARVIS: A fungus is also attacking the scale. It is of a pinkish orange color, and probably is the same one that attacks San Jose scale. I found it on some specimens of Oyster-shell scale sent to me recently. It is also found at Guelph.

Dr. FLETCHER: That is very interesting. I have found this fungus in one or two places but not in Ontario. If you possibly can you ought to try to spread the fungus, Mr. Jarvis. Try inoculating oyster-shell scale and San Jose with it in different orchards. Valuable results might possibly be obtained, at any rate it is wise to try it.

Mr. JARVIS: We have also found a tiny little mite that destroys the eggs. I have seen the statement made that it does not destroy them, but my experience, I think, justifies what I have said. The eggs where these mites were found in the spring were nearly all destroyed, or in some cases were brown in color and clearly never could hatch. In our class work, when examining the scales under the microscope, we have found a large number of scales with these mites in them.

Dr. FLETCHER: We have then three friends to help us in fighting this scale, namely, the four-winged chalcid fly, the mite, and the fungus.

THE TERRAPIN SCALE.

A very brief discussion of this much talked of scale *(Eulecanium nigrofasciatum)* took place :

Dr. FLETCHER: Have any of you had definite information that a satisfactory remedy for the Terrapin scale has been discovered?

Mr. JARVIS: I have not seen the results of any work on the scale further than the statement that lime-sulphur would not kill it.

No one else had any experience with remedies to relate, so Dr. Fletcher said that he had been informed, or had seen a statement that kerosene emulsion utterly failed to kill the insect.

Dr. BETHUNE: The scale has only been reported from three places in Ontario, viz., Walkerville, Windsor and St. Catharines. It does not seem to be spreading. Only maple trees were attacked.

Dr. FLETCHER: What remedy did you recommend?

Dr. BETHUNE: I recommended that the trees shoud be cut down and burned, which was accordingly done.

THE WOOLLY APHIS.

Prof. HUTT brought up the subject by remarking that the Woolly Aphis was very abundant this year in some districts.

Mr. JARVIS: I should think it was. In the orchards around here nearly every young tree has every little crevice or wound on the bark filled with them.

Mr. CROW: I have noticed that they are very bad in the College orchard, but I do not think they have injured the trees much.

Dr. FLETCHER: When did you notice that they were numerous? Was it in summer or autumn?

Mr. JARVIS: In autumn.

Dr. FLETCHER: Has anyone ever found the Woolly Aphis in the root form in Canada? Personally I never have, though it is found in the United States and does much injury there.

Mr. FRIER: When we were taking up some young conifers in the Forestry Department this year, we found a great number of Woolly Aphids among the roots. Would these be the kind you refer to?

Dr. FLETCHER: No, these are a different species. "Woolly aphids" are found on many kinds of trees and there are many different species.

Prof. HUTT: It is very interesting to see the chickadees eating these insects. They seem to devour them with great relish, and soon destroy a great number of them.

BEES AND THE YIELD OF FRUIT.

Prof. HUTT: I should like to call the attention of members to the lack of bees for fertilization this year. I am told that in many districts nearly 80 per cent. of the bees perished during the winter or early spring. Added to this the fact that during the blossoming season we only had a few really good days for the bees to work. I believe it was owing to this that so small an amount of fruit set this year, smaller than usual. I firmly believe that fruit-growers should keep more bees. I notice that men who keep bees have a better set of fruit. Mr. Dempsey, of Trenton, is a good example of these men. He has bees and never fails to get a good set of fruit.

Dr. FLETCHER: I am glad you brought this subject up. Mr. Macoun, of the Experimental Farm at Ottawa, called my attention to the splendid crop of apples we had this season, whereas the apple crop for miles around Ottawa was almost a failure. The only explanation I can find is that we had bees to help us and other people had not.

Prof. HUTT: Do wild bees assist to any extent in the fertilization of fruit blossoms?

Dr. FLETCHER: Certainly, but not to the same extent individually as the honey bee. The latter seems to be especially built for this purpose. He seems to delight in getting covered all over with pollen and conveying it from one blossom to another.

Dr. BRODIE: Many families of wild bees do a great and excellent work in fertilization: especially is this true of the great family Andrenidæ, of which there are about 100 species: the Syrphidæ and Halictus, also, do good work in fertilizing fruit blossoms.

SAN JOSÉ SCALE.

A short discussion on this scale was brought about by the reading of the following letter from Mr. J. Fred. Smith, San José Scale Inspector for Ontario:

"One of the most noticeable things in connection with the San José scale this year was the lateness of the commencement of the breeding season; and owing to the lateness of the spring in opening large numbers of them starved to death. Another peculiarity therewith was that this was most noticeable on heavy cold soils. On the warmer and earlier soils they have done fairly well. In other words in all those sections where early gardening is done and where vegetation started early the sap also began to flow earlier, and as this is their food they were consequently started in their work of destruction in good shape.

"I am also pleased to inform you that never before was there so much treating done for its destruction. Lime and sulphur was the almost universal remedy and so much sulphur was used that there was a sulphur famine. At Leamington, towards the last of the season, none could be got at all. In village and small town lots considerable Target Brand and Carlson's Mixture was used, but on account of the large quantity of scale that were winter killed it was almost impossible to form an opinion as to their value. At Leamington I made an inspection, along with the local Inspector, of several lots treated with Target Brand, and as I was not then aware of the large quantities winter killed I had to give the Brand credit for doing the good work; but later I found some lots that had not been treated at all and there was very little life to be found. The examination at Leamington was made on the 5th of July. On the 30th of July, at Bartonville, on trees which had not been treated for the scale larvæ were to be found running, which is the latest that I have ever seen in Ontario."

Miscellaneous.

The remainder of the time set apart for the conference was employed in discussing a variety of insects, respecting which information was desired. For the potato flea-beetle it was stated that Bordeaux mixture had proved to be the best remedy, and also for that attacking cucumbers; poisoned-lime is useful for the grape-vine flea-beetle and is made with Paris green and lime so thick that it can only just be sprayed. For the oyster-shell scale the lime wash (made in proportion of one pound of lime to a gallon of water) has proved entirely satisfactory. It should be applied in the autumn as soon as the leaves have fallen, and be repeated a few days later. Two applications of this thin wash are more effective than a single one made with double the amount of lime. For slugs attacking celery, freshly slaked lime was recommended, to be put on before hilling up the plants, and repeated for two or three days in succession. The lime sticks to the slimy bodies of the slugs and kills them through its caustic effects.

Mr. W. R. Thompson mentioned that millipedes attacked tomatoes in large numbers at Ste. Anne de Bellevue this summer, especially injuring any fruit that touched the ground. The chairman advised as a remedy a dressing of nitrate of soda.

REPORTS ON INSECTS OF THE YEAR.

Division No. 1,—Ottawa District: By C. H. Young, Ottawa.

During the past season I regret to say I have been unable to devote as much time as I should have liked to the study of the insects of the Ottawa district, which have appeared in destructive numbers.

The following notes, however, are submitted:

The small White Cabbage butterfly (*Pontia rapæ*), was very plentiful in the district and its ravages in neglected gardens could be easily seen. It was particularly troublesome towards the end of August. On August 22nd I visited a large garden at Billing's Bridge, near Ottawa, and here the injury was to cauliflowers. The insect-powder remedy is such a simple one that I cannot understand why growers of cabbages and other plants which are attacked, allow this insect to destroy their crops.

The Colorado Potato beetle (*Leptinotarsa decemlineata*) was particularly abundant in many potato patches. Although the season was a poor one for potatoes, those growers who sprayed with the poisoned Bordeaux mixture were well rewarded.

Grasshoppers were very numerous at Meach's Lake, Que., near Ottawa. In one garden of a friend of mine all the flowering plants were completely destroyed, while in another large garden about half a mile away flowering plants were saved by allowing chickens to run in the garden. This is another instance of the value of poultry in reducing the numbers of injurious insects.

When these domestic animals once acquire the habit of feeding on grasshoppers and cutworms, they become of so much more value to the owner. At Billing's Bridge grasshoppers were also noticed injuring cauliflowers and other crops of vegetables.

The Fall Webworm and the Yellow-necked Apple-tree caterpillar appeared in considerable numbers and their injuries were very apparent throughout the district. Where these insects were troublesome on shade or ornamental trees, the simple remedy of cutting off the infested branches was resorted to. Halisidota caterpillars of two species, the Hickory Halisidota (*Halisidota caryæ*) and the Spotted Halisdota (*H. maculata*) were responsible for much injury to the foliage of many trees and other plants in late August and early September. At Rockliffe Park, near Ottawa, the caterpillars of the Spotted Halisidota were abundant on willows, basswood and Wild Rose.

Several colonies of the Black Walnut worm (*Datana integerrima*) were observed as very destructive to cultivated Black Walnuts and Hickories. This insect, however, cannot be usually considered an injurious one at Ottawa as it does not occur in sufficient numbers to do serious damage. Cutworms, while troublesome in some gardens, were not responsible for very much damage, as far as I know, in the district, during the past season. The poisoned bran remedy is becoming more widely used every year.

Root Maggots, too, were not in such numbers as to cause much anxiety to market gardeners during the season of 1907.

Division No. 2.—Midland District. By C. E. Grant, Orillia.

The year of 1907 was a remarkably backward season; on the 27th of May I walked home in half an inch of snow and the wind blowing a blizzard, then a short three months of summer which was excessively dry.

No very serious complaints of insects were reported to me.

There were, however, widespread complaints of the Buffalo-beetle, which has apparently invaded most houses and no efficient remedy seems to have been found or else the remedy is not properly applied.

The currant saw fly and the codling moth were also very bad this year and the apples here (in fact most fruits) were small, therefore the crop was poor. The cutworms were also rather plentiful.

Though perhaps not doing much damage, the Walking-sticks were to be met with very often and lots of people brought them to me, who before would have been ready to swear that there was no such insect in existence.

Grasshoppers were very plentiful late in the season and devoured a lot of the leaves which were left after the drouth.

Late in September immense numbers of the Buprestid (*Chrysobothris femorata*) were running over the cement walk of the main street and were crushed by pedestrians. I tried to trace the source of the supply but could not.

The Fall Web-worm was very much in evidence. I also noticed the remarkable number of Halisidota and Acronycta or Apatela caterpillars: they were all over the fences and until quite late in October. I took two specimens of Telea polyphemus in August, quite an unusual occurrence.

I have only added one new moth to my locals this years, viz., *Plagodis keutzinzii*.

Division No. 3.—Toronto District. By J. B. Williams, Toronto.

The Tussock Moth still continues to do a good deal of damage to the shade trees in Toronto, though they have not been quite so numerous this summer, as far as I have observed, as they were a year ago. The comparatively cool weather may have acted to some extent as a check upon their numbers, or possibly parasities are beginning to get the upperhand, and we may see their gradual diminution by natural causes, during the next few years. They have certainly appeared for some time past to be having everything their own way.

The Tent caterpillars have been numerous round Toronto, and I saw a good many of them in the country round Lake Simcoe.

The Codling Moth has been very destructive to many apple trees in the city gardens. In the same orchard some trees have hardly been touched by them, while others have had almost every apple more or less injured by the ravages of this injurious pest.

Though the Walking-Stick insects were very numerous last year at Niagara Glen and swarms of them had stripped several large trees of their foliage, I failed, this year, to find a *single specimen* on two or three occasions when I visited the place. What can have been the cause of their sudden disappearance?

Division No. 4.—East York District. By C. W. Nash, Toronto.

The past season seems to have been an unfavorable one for the development of most forms of insect life. Butterflies were particularly scarce, even the common species which usually swarm about the garden and over fields of blossoming clover, being conspicuous by their absence. I did not see one Monarch Butterfly (*Anosia archippus*) until the first week in August, after which a few were noticed every day, but so far as I could observe, there was no congregation prior to migration, and no regular flight in September such as usually takes place along the shore of Lake Ontario from east to west, when the insects are on their journey to the south. On the other hand many were here later than usual; a few having remained until October, 5th, when the last were seen.

Cosmopepla carnifex.—During the past few years this beautiful little hemiptera has been gradually increasing in numbers until in June, 1907, it became enormously abundant on Aquilegia, Antirrhinum and Pentstemon

in gardens. On the 25th of June all the plants of these genera in this neighborhood were covered with the insects and a vast number of eggs had been deposited upon the main and flowering stems of the plants. I was curious to know what would happen when all the eggs were hatched for it seemed as if they would produce enough insects to over-run the country. Apparently the season was unsuitable for the development of the nymphs or one of the many disasters to which "feeble folk" are subject overtook them, for by August there were no Cosmopeplas to be seen. The millions of adults which appeared in the spring had all passed away and there were none of their progeny to represent them.

I have not yet been able to discover what this insect feeds upon. As it resorts to Aquilegia, Antirrhinum and Pentstemon and upon them its eggs are deposited, it would seem that these plants should supply its food. Yet although hundreds of adult and immature Cosmopeplas may be upon a plant, no perceptible harm is ever done to it, and all my efforts to raise the nymph from the eggs have proved abortive, though I kept them well supplied with shoots from the plants upon which the eggs were deposited. I tried them also with Aphides under the impression that perhaps they lived upon the juices of other insects, but this too was a failure.

Locusts.—Just before harvest time locusts became troublesome in the oat fields, where they did some damage by cutting off the ripening grain from the stalk and dropping it to the ground. In some fields the soil was covered with the grain so cut off. Under ordinary circumstances the loss would be somewhat serious, but this year, owing to the short crop, is doubly so.

The Stalk-borer (*Gortyna cataphracta*). Perhaps the worst enemy vegetables growers and florists have to contend with now is the larva known as the Stalk-borer. This creature has increased rapidly in numbers during the past five years and unless it is checked by some of its natural enemies will cause great loss and annoyance, as it is almost impossible for man to control it by any mechanical means. During this past season I took over two dozen larvæ from the stems of plants in my garden of about a quarter of an acre and I received great numbers from market gardeners and florists both amateur and professional of this district. It is practically an omnivorous feeder, any plant, either wild or cultivated, having a stem large enough to contain it being liable to attack and unfortunately the infested plant shows no sign of infestation until the larva has eaten out the heart of the occupied stem. When this occurs the stem breaks off or its leaves wither and die. If it is the main stem which is occupied, as is generally the case with tomatoes and corn, the plant is ruined.

I have not yet been able to ascertain where or when the moth deposits the eggs from which the larvæ are produced. It might be that the moth hibernates and deposits its eggs upon the shoots of plants in the spring, but I have not yet found an adult dormant, nor have I seen it in the spring.

In July the work of the larvæ is first noticeable, and a rather peculiar thing is that, almost up to the end of the month, larvæ varying in size from about one-third to full grown may be found in close proximity; this year I found on the fourteenth of July a number showing among them even greater variations than that.

About the twenty-fifth of July the more advanced specimens begin to enter the pupal stage, the smaller ones continuing to feed sometimes well on into August. Early in September the moths begin to emerge and continue doing so until the end of the month when they are at the height of their abundance, and on dark nights come to light in large numbers. This year

they were rather later than usual and I did not see as many moths flying as in 1905 and 1906. In the latter year they were very abundant at light on the night of September 26th, which was dark and rainy.

Although I have bred a great many of these insects from the larval state to maturity, I have never found one parasitized and their method of life, no doubt, protects them largely from enemies of this class.

The Tarnished plant bug, though still more in evidence than was pleasant, did less mischief than usual, and Aphides, though rather abundant in spring, became less so as the season advanced. Dragon-flies were very scarce indeed, so much so that in the marshy meadows where they usually abound I did not see this summer, one for every hundred generally to be found in these localities. Bumble -bees also were far less numerous than they should be for the good of the country. Of the five or six nests provided by me for them, not one was occupied, though for the previous five years every one has been tenanted.

Division No. 6.—London District. By J. A. Balkwill.

In this neighborhood we have been fortunately, almost exempt from serious injury from insects with one noteworthy exception that was an unusually large number of cutworms which attacked almost every kind of garden vegetable even boring into onion stalks; one party tells of taking 30 off one tomato plant; the larvæ were nearly full grown and soon went into pupation.

The Cottony Maple scale which disfigured our maple trees for a number of years has almost entirely disappeared.

The Tussock moth we have in considerable numbers but not numerous enough to cause alarm.

Nothing is heard about the Pea Weevil although an occasional one is found in the peas which were sown early.

After these reports were read, a short discussion followed, in the course of which Prof. Hutt said that the Rose Chafer was very injurious near Leamington this year. The English Sparrow had developed a taste for them and devoured great numbers. This is one point to be scored in favor of these birds. Mr. Cæsar said that he had been sent some specimens of insects from Toronto which were reported to be destroying almost everything in a garden. They proved to belong to the Fulgoridæ and were identified by Dr. Bethune as *Ormenis pruinosa*, Say. They seemed to be fairly numerous about Toronto and were found on tree trunks when he visited the city about the middle of July.

EVENING SESSION.

Thursday, October 31st, 1907.

In the evening Mr. A. H. Kirkland, of Boston, who is in charge of the efforts now being made in Massachusetts to suppress the Gypsy and Brown-tail Moths, gave a highly interesting account of the work and the results that have so far been accomplished. His address was illustrated with a series of lantern pictures which graphically showed how the operations are carried on. He described also the importation of parasites and some pre-

daceous beetles from Europe, and the amount of success which had so far attended their efforts to breed them. Dr. Fyles followed with one of his charming papers "The Voices of the Night." Much regret was expressed that the attendance was small owing to the attractions of the holiday, it being Thanksgiving Day and Hallowe'en

THE GYPSY AND BROWN-TAIL MOTHS IN MASSACHUSETTS.

ABSTRACT OF ADDRESS BY A. H. KIRKLAND, SUPT. OF GYPSY MOTH WORK, BOSTON, MASS.

After congratulating his audience upon the evidences of agricultural prosperity shown in the parts of the province through which he had passed, and speaking of the serious loss to agriculture often inflicted by injurious insects, Mr. Kirkland took up the matter of imported insect pests, and explained why they were so much more injurious to crops and trees than native insects.

"In a state of nature, every insect has its enemies, such as birds, diseases, and, most important, insect parasites. When an insect pest is transported thousands of miles to another country, and is thus freed from its natural enemies, it multiplies remarkably, and causes much greater damage than when in its native environment, simply because it is relieved from those checks which nature has provided for it. Thus the San José scale is much more injurious in this country than in its native home in Northern China. The Elm-leaf Beetle and the Gypsy and Brown-Tail Moths also give striking illustrations of this fact. These two moth pests have caused most serious havoc in eastern New England, have spread rapidly, and one, at least, the Brown-tail Moth, occurs in the Maritime Provinces of Canada."

The speaker then described the importation of the Gypsy-moth to Medford, Mass., by Professor Leopold Trouvelot in 1868, its accidental escape from his care, and its slow but constant spread throughout the neighboring towns. "Recognizing the importance of the catastrophe, Professor Trouvelot promptly gave notice to Doctor C. V. Riley, then State Entomologist of Missouri, and also to Doctor Hagen, at Harvard University Unfortunately, no great importance was attached to the matter, although at this time $1,000 would have cut and burned over the many acres of brush land in the vicinity of Profesor Trouvelot's home and wiped out the incipient moth colony. The moth increased unrestrictedly for some twenty years, but in 1888 the public of Medford and vicinity suddenly woke up to the fact that they had a serious caterpillar plague on their hands, and at once made vigorous efforts to combat it. One year's experience was sufficient to show them that individual effort could not control this formidable pest, and the aid of the cities and towns was invoked. Another year convinced the cities and towns in turn that they could not fight the insect unaided, and the State of Massachusetts was asked for help. The work in Massachusetts began in 1890 and was continued until February 1, 1900, principally under the auspices of the Massachusetts Board of Agriculture. This work suffered in certain critical years from lack of sufficient appropriations, or from appropriations not made in season for most effective action. At the same time, great progress was made in bringing the insect under control, until in 1900 but few moths could be found anywhere in the infested region. The insect had been thoroughly suppressed

by the application of hand methods, so-called, many of which were invented to meet the needs of the work. In 1899 not over ten acres of woodland were stripped in the entire infested district, which embraced some 350 square miles. In 1900, although it was pointed out to the Massachusetts Legislature, that scattering moths remained here and there in the district, that body, in its wisdom, saw fit to discontinue the work, partly from political reasons, in spite of the protests of entomologists who thoroughly realized the gravity of the situation, because of the prolificacy of the moth. During this campaign about $1,250,000 was expended, and the moth had been brought thoroughly under control. The insect at once began to increase steadily, yet nothing more was done in the warfare against the moth pest until 1905, when the caterpillar plague had again become such a nuisance that the work was resumed under a co-operative plan whereby the citizens directly bear part of the expense of supressing the insect, cities and towns another part, and the State the major part. In other words, the present scheme of work involves a direct co-operation of property owners, cities and towns and the State, under the general direction of the central office, thus insuring uniformity of action. Under this scheme of work, upward of $750,000 was expended during 1906, and as much will be laid out the present year.

"The principal means by which the Gypsy moth is spread over its present area of some 2,800 square miles, is through caterpillars spinning down from the trees and dropping on automobiles, teams, cars, etc. Fortunately, the female moth does not fly but the insect spreads rapidly in the manner mentioned. A volume might easily be written on the means by which the Gypsy moth is spread. The young caterpillars spin down by thousands from neglected, infested trees in May and June. Where such trees overhang highways, every milkman, every grocer, every garbage man,. in short, every vehicle gathers them and carries them to a greater or less distance, thus founding innumerable new colonies. In the badly infested district regular daily traffic of the classes m ntioned above is most dangerous. Long distance scattering of the moth is effected principally by pleasure driving, electric cars, and what is most important of all, automobiles. The advent of the latter class of vehicles has greatly complicated the prevention of the spread of the pest, and makes it all the more imperative that we should keep clean the trees that border our main roads. Other minor methods of distribution are eggs deposited on barrels, packing boxes, summer furniture standing out of doors, etc.

"The Brown-tail Moth found its way to Somerville in the early nineties no doubt on rose bushes imported from Holland. The evidence in this case is circumstantial but strong. The insect is known to occur in Holland, is known to form hibernating webs on roses, and the place where it was discovered in Somerville, Mass., in 1897, was directly in the rear of a florist's establishment, where a specialty was made of importing Dutch roses, growing them for a season and then selling them to the Boston department stores. The female moths of this species fly freely, and are often carried long distances by the wind. They are also strongly attracted to light. Cases are on record where these strong flying females have come on board vessels some thirty miles off the New England coast. It is not surprising then that the Brown-tail Moth has already spread to Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, New Brunswick and Nova Scotia. The line of spread is naturally that of the prevailing winds during July, which in New England usually blow to the north-east. It seems probable that in comparatively few years this insect may be found generally scattered throughout New England and Eastern Canada.

"The biology of the insects is briefly this: in the case of the Gypsy Moth the eggs hatch about the last week in April, the caterpillars, which feed on all kinds of foliage are full-grown about the middle of July. Words cannot describe the havoc wrought by these caterpillar swarms. In early July of the past year, some 3,000 acres of mixed woodland in Eastern Massachusetts were defoliated by the gypsy caterpillars, and left as bare as in winter. They feed on all trees, nearly all crops, and often invade houses by the hundred. No more pitiful and at the same time disgusting sight can be conceived than a gypsy moth outbreak at its height. No wonder that in the olden days before the science of economic entomology was dreamt of, people so afflicted sought a remedy through prayer, or that they regarded the pest as a device of the Evil One. The pupal stage extends to about the 1st of August, while the moths are from a week to ten days in depositing their yellow, hair covered egg clusters. The egg clusters are laid on tree trunks, stone walls, houses, fences, and old tin cans—in fact, in all places where the caterpillars may go to pupate. The female seldom moves far from the pupa case from which she has emerged.

"With the Brown-tail Moth the eggs hatch about the middle of August, and the young caterpillars feed at the tips of the twigs, preferably those of fruit trees, until the approach of cold weather, when they draw together the leaves from which the epidermis has been removed, and spin them up with a most tenacious web, thus forming a hibernaculum within which they congregate to the number of two or three hundred, and thus safely pass the winter. The same warm weather that causes the buds to swell the following spring brings out these small caterpillars, which feed on buds, blossoms, and leaves, and when abundant, often strip entire orchards and groves of oak. Aside from the damage to trees the hairs of the caterpillars are intensely poisonous and cause a severe and most painful eruption of the skin whenever they come in contact with it. By the middle or latter part of June, the insects are fully grown when they spin cocoons, often in masses at the tips of twigs, on fences, and even house walls. From the 12th to the 15th of July the white, brown-tail moths emerge, fly freely, mate principally by night, and the females at once begin the work of oviposition. Some four or five days are consumed in this process by which time the brown, elongated, hair-covered egg masses have been securely attached to leaves at the tips of twigs. Hatching takes place in from three to four weeks.

"For remedial measures against the Gypsy Moth we have found spraying done in the early caterpillar season the most valuable of any single method. Power sprayers, throwing the spray under heavy pressure have proved the most economical, as far as street tree and orchard work is concerned, and also, in those woodlands which are accessible to heavy machines. In woodland spraying, however, the thinning of trees, and cutting out of underbrush is an indispensable prerequisite, and this preliminary work is usually done during the previous fall and winter months. In spraying against the Gypsy Moth, arsenate of lead paste at the rate of 10 pounds to 100 gallons of water gives the best results. On rough or rocky hillsides, and in other places where the power sprayer cannot be worked to advantage, hand spray pumps are freely used with good results. As the caterpillars approach maturity, they show considerable resistance to poison, and further acquire the odd habit of feeding by night and hiding by day in sheltered places. Taking advantage of this habit we band the infested trees with strips of burlap, beneath which the caterpillars assemble in the early morning hours, and where they may be destroyed at any time by hand during

the day. Later in the season, the pupæ and female moths are crushed by hand or creosoted wherever found, while after the eggs are laid coal tar creosote applied with a brush to the egg masses completely destroys them. This creosoting of the egg masses is carried on throughout the fall, winter and spring, and is a most effective though somewhat expensive method. In badly infested woodlands we thin the trees, cut the brush and treat the egg masses on the trees left standing. The following spring we band the remaining trees with some sticky material to prevent the ascent of the young caterpillars, and as soon as all the eggs on the ground have hatched, a light fire is run over it, thus destroying the caterpillars by the million. These are the principal methods directly used for destroying this insect. As a matter of policy we have attempted first to stop the scattering of the moth by treating a 100 foot belt on each side of all our main roads. This prevents the caterpillars from spinning down and dropping on vehicles. In this way, over 8,000 miles of roads have been covered during the present season. Next, we have endeavored to do the greatest good to the greatest number of our people by clearing all the important residential sections of the moth, and certainly 90 per cent. of them have been so cleared and protected. There now remains the great woodland problem concerning which we are most anxious, but which we can solve if given sufficient time and money.

"In combating the Brown-tail Moth the natural and most effective measure is to cut off the winter webs, gather them carefully and burn them. This work is best done when snow is on the ground. Where this has been neglected a spraying with arsenate of lead, six pounds to one hundred gallons of water early in the spring will suffice to destroy the insects. In actual field practice the winter work of cutting off brown-tail webs, and of creosoting gypsy moth nests goes on at the same time and with the same gang.

"In opening this informal talk I spoke of the balance of nature; and how injurious insects in their natural environment are ultimately held in check by their parasites. In Eastern Massachusetts we are endeavoring to secure this balance of nature in connection with the moth pests by the importation from Europe of the parasites of both moths. Our State has made liberal appropriations (some $45,000) for this work, which I have placed under the oversight and direction of Dr. L. O. Howard, Washington, D.C., than whom no one in the country is better qualified to direct. Dr. Howard has made several trips abroad for us and engaged a competent corps of collectors in all parts of Europe where the moth occurs. He has also given us the benefit of his advice at all times, and the services of one of his trained assistants who has spent nearly all his time in Eastern Massachusetts looking after the material when it arrives. We have provided for this important work a well-equipped laboratory, and a large number of assistants, and during the past year over 100,000 different forms of parasites of the moth have been bred from European material and liberated in our infested district. We have imported several important Ichneumonids, a very large number of Pteromalids, thousands of Tachinids, and also a large number of predaceous beetles of the genus *Calosoma*. When a sufficiently large number of any of these parasites is obtained at any one time they are liberated directly in the field. Otherwise, they are bred up to the requisite number in outdoor cages and then liberated. What the outcome of this exceedingly interesting scientific experiment shall be, is, of course, problematical. We know already that certain important imported species have established themselves in our State, and are hopeful that another season will show that many others have done likewise. At any rate, the best

available scientific skill is being brought to bear on the problem, while ample financial support has been provided by the State. Both Dr. Howard and myself are very hopeful for the successful outcome of this undertaking. If it can not be gained under present conditions, it can not be gained at all.

"While such great insect invasions are at first glance most discouraging, I am not one of those who regard them wholly as an unmixed evil. I believe that there is in them a certain element of benefit to the community at large. By the attacks of these hordes of insect pests we gain a better appreciation of the value of our trees and crops. We are led to study their needs more closely and to administer to those needs more thoughtfully and efficiently than before, and from thus getting in closer contact with a few forms of life our interests and sympathies become broadened in their relation to the whole living world."

VOICES OF THE NIGHT.

By Rev. Thomas W. Fyles, D.C.L., F.L.S., Levis, P.Q.

Eight years of my early life in Canada were spent in a very beautiful, but comparatively newly settled district in which there was much of the primeval forest remaining. Some of the first settlers were still living there when I took up my abode in the neighborhood. These men told of the nightly howling of the wolves on the hills when they first began to clear the lower lands, and of their encounters with various wild animals in the woods.

My duties at that time took me frequently from home, and my solitary return journeys were necessarily made at night. Driving on the mountain roads, and through the forest, and by the lakes and streams of the locality, I had fine opportunities for studying the "Night Side of Nature"—I use the words in a different sense from that in which Mrs. Crowe used them.

I pity the man who, living in the country, cannot find, at all hours, by day or night, in summer or winter, sights and sounds to interest and instruct him. I pity the man to whom

> "The gracious prodigality of Nature
> The balm, the bliss, the bfeauty and the bloom"

do not appeal. A solitary drive on a country road has always been to me an occasion for rich enjoyment. The many voices of animate creatures--aye, and by a figure, of inanimate objects, also, have formed for me, many a time, a concert well worth listening to.

To speak of the voices of inanimate things I shall never forget one glorious night when the Aurora Borealis held possession of the sky. From the zenith to the horizon, like the ribs of a vast umbrella, but streaming, quivering, vibrating, the rays descended on every side, I stood in admiration, and became conscious of a strange sound. Was I mistaken? I listened intently. I could hear the distant fall of the water over the mill-dam—it was distinct from that. It was like the gentle shaking out of a stiff piece of silken goods. It was a sound of which travellers in Arctic regions have told us—it was the voice of the Aurora.

Who is there who has passed through a grove of pines in the darkness but has noticed the slumberous sighing of the foliage shaken by the night air? I have often listened to it.

Turning now to the consideration of the notes of animate creatures—what a mournful cry was that of the Loon, or Great Northern Diver, as it passed from one sheet of water to another! It was a weird sound coming from far overhead in the stillness of the night, and soon to be answered, from near or far, by the cry of the companion bird.

Sometimes, in the spring or fall, it was very startling to the lonely traveller in the night to hear a—

"—rush as of harpy wings go by."

accompanied by a constant trumpeting of "*conk-conk.*" Looking up, he would see a phalanx of dim forms speeding onward as if to charge an enemy. The sounds came from a flight of wild geese winging their way, to or from, their breeding-ground in the north.

And these sounds would, perhaps, arouse a fox, who would answer them from the hill-side with his short sharp bark.

In those days I often heard the rollicking hearty call of the Great Horned Owl, "*Wo-a-ho-a-hoa,*" shouted from one mountain top, and answered from another by its mate.

Birds of this fine species were numerous in that neighborhood, and sometimes became so bold as to visit the farm yards. A farmer on opening his door early one morning, saw a splendid specimen of the kind blinking and looking very wicked, and fastened to a large, white gander that it had killed. In its efforts to fly off with its prey, it had dug its claws deeper and deeper into the flesh, till it was unable to disentangle them; and, as the gander was too heavy for it to lift, the spoiler became a captive.

A cry less frequently heard, and heard only in the Winter was the dull, heavy "*Bump-bump*" of the Snowy Owl. This bird comes south in the cold weather, but breeds in Arctic regions.

Another sound that I often paused on my way to listen to, was in those days accounted a mystery. Its cause was not known. I will read to you what Gosse, the Canadian Naturalist, said of it:—

"Listen to the singular sound proceeding from yonder cedar swamp. It is like the measured tinkle of a cow-bell, or regular strokes upon a piece of iron quickly repeated. Now it has ceased.

"There it is again. I will give you all the information I can get about it; and that is very little. In Spring, that is, during the months of April, May, and the former part of June, we frequently hear, after nightfall, the sound you have just heard; from its regularity it is usually thought to resemble the whetting of a saw, and hence the bird from which it proceeds is called the Saw-whetter. I say 'the bird,' because though I could never find anyone who had seen it, I have little doubt that it is a bird. I have asked Mr. Titian Peale, the venerable Professor Nuttal, and other ornithologists of Philadelphia about it, but can obtain no information upon the subject of the author of the sound; it seems to be—

'Vox et preterea nihil.'

"Carver, in his amusing travels, mentions it as being heard near Lake Superior, naming it, if I recollect rightly, the Whet-saw. It may possibly be known, but I find nothing of it in Wilson or Bonaparte. Professor Nuttall was acquainted with the note, but told me plainly the bird was unknown. I conjecture it may be some of the herons or bitterns, or, possibly, from a passage in Bonaparte's Ornithology, the Evening Grosbeak (*Fringilla vespertina*). He says of that bird, 'their note is strange and peculiar; and it is only at twilight that they are heard crying in a singular strain. This mournful sound, uttered at such an unusual hour, strikes the traveller's ear, but the bird itself is seldom seen.' "

The sound is really produced by one of the smallest of the Owl family (*Cryptoglaux acadica*). Who it was that first made known the fact I do not know, but it is well established now.

I once saw a pair of these comical owls perched on the roadside fence, where a small brook crossed the way. I was in my waggon; and the confident yet inquisitive looks they gave me were very amusing. Probably, if I had attempted to leave the waggon, they would have flown quickly enough. I inferred that they had come to the brook in search of frogs.

Night-jars were plentiful in that part of the country in the summer. After night-fall they could be dimly seen overhead, hawking for moths and beetles. Their rapid movements, as they chased their prey, were not unlike those of the Tumbler Pigeon. And as they flew they uttered their plaintive call.

Once in a long while the scream of the lynx was heard in the night in that locality, as it was in the day time also. A little son of my next neighbor was passing through the woods one day when he was terrified by the cry of this animal. He started to run; and the lynx bounded along—all four feet in the air at once, after the manner of its progression—keeping a short distance on one side, and uttering repeatedly its startling cry, probably to call its mate. Whether the pair would have attacked the child I cannot say. Happily the sound of a woodman's axe was heard, and this guided the little fellow to safety and frightened the beast away.

In the early Spring the Frog Concert came off with great *eclat*, and was continued night after night. In it were heard the piccolo notes of the tree frog, the trombone of the bull frog, the cackling, croaking, rattling tattoo of the common frog, and now and then, like the jingle of the triangle, the "tr-r-r-ill" of a toad.

There are other sounds that break the stillness of the night—sounds produced by living creatures, but which can only by a figure of speech be termed the "voices" of the existences from which they come. To use the words of Ben Jonson:

"The scaly beetles, with their habergeons,
Do make a humming murmur as they fly."

Lachnosterna fusca, Fröhl, is the beetle that comes from the large white grub that is dug up so often in our gardens. Its shards, or elytra, are held erect while the true wings which are membraneous really bear the insect up, and by their vibrations produce the humming sound.

The impertinent "twang" of the mosquito is produced in like manner: and it is wonderful that wings so delicate and frail in appearance as those of the mosquito can be exercised with such rapidity as to produce so shrill a sound.

The antennæ of insects are supposed to serve instead of ears; and it may be that long and delicate antennæ with which many of the smaller kinds of Neuroptera are supplied were intended to catch the pulsations in the air caused by the rapid vibratory action of the minute wings of their compeers. Sounds we cannot hear are in all probability made known to the tiny companions of the creatures that produce them.

The wayfarer in the dusk of evening, who will pause near a patch of the Silk-Weed (*Asclepias cornuti*) in full blossom, will probably hear a distinct and continuous humming caused by the motion of the wings of the Sphinges and other moths, that flit from plant to plant, or hover over the blooms, and through their long and slender trunks, imbibe the nectar that Flora in her bounty has provided for them.

As the Summer advances, on nights when the weather is calm, the whole atmosphere seems to palpitate with the multitudinous calls, shrillings, chirrupings and sibillations of various orthopterous insects. The Naturalist with a good ear who will take Scudder for his guide,* and endeavor to distinguish between the notes of the different serenaders will have set himself an interesting task.

Day and night the Naturalist finds entertainment and food for reflection. It must be said though that the pursuit of Natural History is not always free from danger.

It is the custom, you know, for Entomologists to spread a mixture of molasses and rum upon the bolls of trees at nightfall, to attract Noctuids and then, at intervals, to visit the baits, carrying a dark lantern and the useful cyanide bottle.

A party of Montreal gentlemen were engaged in this "sugaring"—as it is called, in the outskirts of their city, when the sound of a pistol-shot broke the silence, and the *ping* of a bullet sounded unpleasantly near them. I need hardly say that their sugaring operations were abandoned for that night.

And this story reminds me of an experience of my own, in the long ago, when I was young and enthusiastic.

There was a wood about three miles from the town where I was living, and about the same distance from any other place—it was a lonely wood, I was accustomed to resort to it for Entomological researches. It was a grand hunting-ground; and I knew every part of it thoroughly. I was never disturbed nor molested there by anyone. I became very bold; and one night I determined to go there for sugaring purposes. I took a jar of prepared sweets, a dark lantern, and a supply of chip boxes; and I reached the wood about eleven o'clock. I had fairly entered and was preparing for work, when *bang! bang! bang!* broke upon my ear. I was startled you may well believe; but I understood the position in a moment; there were poachers in the wood shooting the pheasants at roost in the trees; and the men were but a few rods away. I said to myself, "If these men come upon me they will take me for a game-keeper; and if the game-keepers, hearing the guns, should hasten to the wood and find me here, they will take me for a poacher. In either case I shall fare badly." So I thought discretion the better part of valor, and made for my home as quickly and as quietly as I could.

It may be asked, of what interest to *Entomologists* are the Loon, the Fox, and the other creatures you have spoken of? To come to an answer you must follow a concatenation, such as that which connected the "priest all shaven and shorn" with "the malt that lay in the house that Jack built" and say:—

This is the Loon
That swallowed the Frog
That fed on the Gnats
That troubled the Folk
That lived in the house that Jack built

This is the Fox
That killed the Hen
That ate the Grigs
That leapt in the grass
That grew round the house that Jack built.

I remember a conversation that I had with the late Sir William Dawson. We were speaking of the Entomological Society of Ontario. He said. "I see that you have Geological, Ornithological, and Botanical Sections of your Society. We have regarded the studies that these pursue as of more importance than that which you make your chief consideration. The whole is greater than its part. But your proceedings show how one branch of Science intertwines with others."

* (See "Songs of our Grasshoppers and Crickets," by Samuel H. Scudder, Twenty-third Report Ent. Soc. of Ontario, 1892, page 62).

I trust then that my reference to animals, birds and reptiles will not have been deemed inappropriate on this occasion.

Dr. Fletcher, in expressing the thanks of the audience for the interesting addresses that had been given them, drew attention to the wonderful success which had attended Mr. Kirkland's efforts. He had himself spent some time in Massachusetts during the early part of the summer and had seen what was being done. Mr. Kirkland was one of those all-round men who realized that each branch of knowledge had a close relationship with every other branch. He was not only a good entomologist, but also a good chemist, and he brought his chemical knowledge into practical use to aid his entomology. As a result he showed all North America the great value of arsenate of lead as an insecticide. Mr. Kirkland's task was the most extensive experiment in economic entomology that had ever been undertaken in the United States or in any other part of the world, but he is a man of great executive ability and is able to organize and control his great staff of 1,700 men and to use to the best advantage the large sums of money provided by the State Legislatures and Municipalities for the suppression of the Gypsy and Brown-tail Moths. We in Canada are deeply interested in the work inasmuch as the latter of these pests has invaded Nova Scotia and is producing consternation and dismay among many fruit-growers there.

SECOND DAY'S SESSION.

The President, Dr. Fletcher, took the chair at 10 o'clock in the Biological lecture room of the Ontario Agricultural College, Guelph. There were present during the day a large number of students in addition to the members of the Society. The first order of the day was the reading of the reports of the Council, the branches of the society at Montreal, Quebec, and Toronto, and of the Treasurer, Librarian, Curator and the Delegate to the Royal Society of Canada. This was followed by the election of officers for the ensuing year 1907-8, which resulted as shown on page 6. Dr. Fletcher was re-elected president, as were also the other officers with the exception of the delegate to the Royal Society, for which position Mr. Arthur Gibson, of Ottawa, was chosen in succession to Mr. A. F. Winn, of Montreal.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present its report for 1906-7.

The forty-third annual meeting of the Society was held at its new home in the Ontario Agricultural College, Guelph, on the 10th and 11th of October, 1906, and was attended by many members from a distance and also by a large number of students of the College and Macdonald Institute.

The first afternoon was devoted to a conference on the Codling-worm, during which its whole life history was discussed, the value of parasites as a means of control was considered and many practical points were brought out by the various speakers who took part in it. This was followed by the

Reports on Insects of the year presented by the directors from their respective divisions of Ontario.

In the evening a public meeting was held in the Massey Hall which was nearly filled with an appreciative audience in spite of the inclemency of the weather caused by the first snowstorm of the season. After a hearty welcome from President Creelman, the President, Mr. John D. Evans, read his address, and was followed by a paper on "What the Entomological Society of Ontario can do for the Ontario Agricultural College," by Professor Lochhead, and a description of "A Canoe trip for Entomological Purposes through the Algonquin Park"—illustrated by a number of original lantern views—by Mr. Paul Hahn, of Toronto. The second day was occupied with the reading of reports from the branches and officers of the Society and a series of scientific and practical papers, all of which have been published in the annual volume.

This volume, the 37th Annual Report to the Legislature of Ontario, was published in May last and contained 120 pages, a portrait of the retiring President, Mr. John D. Evans, and six beautiful half-tone plates of Galls from a variety of trees. Besides the papers already referred to it included the following articles: "A Hunt for a Borer," by Mr. H. H. Lyman; "Two Insects affecting Red Clover and Seed Production," "Insect Galls of Ontario," "The Locust Mite," and "The Oyster-shell Bark Louse," by Mr. T. D. Jarvis; "Hemiptera," "In the tracks of *Nematus Erichsonii*" and "The Notodontidæ of the Province of Quebec," by Dr. Fyles; "Basswood, or Linden, Insects" and "The Bean Weevil," by Mr. A. Gibson; "Insects injurious to Ontario Crops in 1906" and "The Entomological Record, 1906," by Dr. Fletcher; "Injurious Insects of 1906 in Ontario," by Prof. Bethune.

A summer meeting of the Society—the first for a great many years—was held at the Ontario Agricultural College on the 4th and 5th of July. Through the kindness of President Creelman, the members from a distance were hospitably entertained in the College residence during their visit, and the ladies of the party were provided for in the Macdonald Hall. There were present also a number of Ontario teachers who were taking a summer course of Nature Study at the Macdonald Institute, and several students and members of the College staff. The first afternoon, the President, Dr. Fletcher, occupying the chair, papers were read by Mr. Lyman on the distinction between *Thecla calanus* and *Edwardsii;* Dr. Brodie on the life-history of a colony of Tent Caterpillars and the parasites infesting them; Dr. Fletcher on the control of the Gypsy and Brown-tail moths in Massachusetts by the importation of parasites from Europe, and Mr. C. W. Nash on "Balance in Nature." In the evening Dr. Henry Skinner, of Philadelphia, gave an interesting lecture on "Insects as Carriers of Disease;" Mr. Nash spoke upon "Instinct *vs.* Education," and Dr. Fletcher gave an instructive address on "Nature Study as a means of Education." The second day was devoted to an excursion to Puslinch Lake, about sixty taking part in it; after some hours spent in collecting entomological and botanical specimens, short addresses were given by the College staff and others upon the various objects of interest that had been brought in.

At a subsequent meeting of the Council, Mr. L. Caesar, O. A. College, was elected secretary for the remainder of the year in place of Mr. E. J. Zavitz, who resigned on account of the pressure of his duties in the Department of Forestry, which left him no time to devote to the business of the Society.

The Canadian Entomologist, the monthly magazine of the Society, has been regularly issued at the beginning of each month. The 38th annual volume was completed in December last, and ten numbers of the 39th volume

have now been published. The volume for 1906 contains 425 pages and is illustrated with four full-page plates and 48 figures from original drawings. The contributors numbered 66 and included writers in Canada, the United States, Hawaiian Islands, England and Jamaica.

From October to the middle of May meetings of the Society were held in the Biological lecture-room on alternate Wednesday evenings, and occasionally more frequently. The members of the Wellington Field Naturalists' Club joined with those of the Society in the proceedings and thus a variety of biological subjects were discussed in addition to those of an entomological character. The attendance was very satisfactory, many Nature Study students and members of the third and fourth years being present at most of the meetings.

The reports from the branches of the Society at Montreal, Quebec, Toronto and British Columbia are very satisfactory, meetings having been regularly held and many papers read and discussed. The last named branch has published a quarterly Bulletin containing lists of British Columbia insects of various orders and many highly interesting notes and observations.

The newly organized Entomological Society of America held its first meeting in New York at the end of December last. It is gratifying to record that our Society was recognized by the election of Dr. Fletcher as first Vice-President, and Dr. Bethune as a member of the Executive Committee; both these gentlemen are also original Fellows of the new Society. In August the Society held its second meeting at Boston during the sessions of the Seventh International Congress of Zoologists; Dr. William Saunders, of Ottawa, and Mr. H. H. Lyman, of Montreal, two of our members of long standing, were elected Fellows, and Dr. Bethune, one of the two representatives of the Society on the Council of the American Association for the Advancement of Science.

JAMES FLETCHER, President.

ANNUAL REPORT OF THE MONTREAL BRANCH.

The 284th regular, and 34th annual meeting of the Montreal Branch was held on May 11th, at the residence of Mr. Geo. A. Moore, 209 Prince Arthur Street.

The following were present:—Mr. G. A. Moore in the chair; Messrs. H. H. Lyman, G. Chagnon, E. C. Barwick, E. Denny, A. E. Norris, E. Kollmar, G. R. Southee, C. W. Sach, A. F. Winn.

The Secretary read the following report of the Council:

During the year, meetings have been held monthly, excepting in July, August and September, the attendance averaging seven members. Four new members have been added to our roll, Messrs. M. W. Davis, C. S. Fosbery, E. Kollmar, C. W. Sach.

A field day was held on May 24th at St. Hilaire, and several members attended the outing of the Natural History Society at St. Gabriel de Brandon.

The papers read at the meeting were:

"Reflections and Suggestions," Henry H. Lyman.

"St. Hilaire, May 24, 1906," G. A. Moore.

"Notes on Coleoptera collected by Mr. Moore at Como, Que.," G. Chagnon.

"Collecting Catocalae in the day-time," E. Denny.

"Collecting Hemiptera at Como," G. A. Moore.

"The Genus Chrysbothris, with notes on Canadian Species," G. Chagnon.

"Clastoptera," G. A. Moore.

"Thecla calanus and T. Edwardsii," Henry H. Lyman.

Specimens of the following genera of moths were brought together at the various meetings for comparison and study:—Xylina, Acronycta, Datana, Hadena, Feltia and Heliophila, resulting in a better knowlege of these groups, and the correction of several errors in identification.

Your Council would again urge the members to write short notes for the meetings, and also to prepare for the fall meetings, reviews of the summer's work in the field, experiences in breeding species, studies of habits, etc.

Additions to our collection of specimens, books and photographs should not be forgotten.

St. Madeleine, Que., has been suggested as a locality suited for the field day on May 24th.

Respectfully submitted,

(Signed) GEO. A. MOORE,
President.

The treasurer's report showed a balance on hand of $59.40. The reports of the curator and librarian were also submitted and adopted.

The following officers were elected:—President, Geo. A. Moore; Vice-President, E. C. Barwick; Sec.-Treasurer, A. F. Winn; Librarian and Curator, L. Gibb; Council, G. Chagnon, H. H. Lyman, G. R. Southee, E. Denny.

REPORT OF THE QUEBEC BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Quebec Branch of the Entomological Society of Ontario has pursued its useful course for a period of ten years.

We have had to mourn the demise of some of our members and to bid adieu to others who have moved to distant localities, but additions to our membership have from time to time encouraged us.

The authorities of Morrin College still allow the Branch to hold its meetings in that institution—a privilege that is highly appreciated by the members.

The past season has been, for the most part, an unfavorable one for entomologists, on account of the frequent rains, but much good work in collecting was done by our curator, Mr. A. R. M. Boulton. Such fine moths as *Ceratomia amyntor*, Geyer, *C. undulosa*, Walker, *Sthenopis argenteo-maculatus*, Harris, being taken by him.

Mr. Boulton also, on one of his excursions, discovered a batch of Hemaris larvæ, feeding upon a solitary bush of *Viburnum opulus*, Montmorency. The larvæ are true Sphinges in form and attitude; but they lack the transverse side-lines that other Sphinges have, and they do not bury themselves in the ground when full fed, but spin a slight cocoon among leaves above ground.

Another interesting batch of larvæ was brought from Miranda, P. Q., by Miss Johnson, one of our members. It was one of *Anisota Senatoria*, S. & A., a species that has not hitherto been taken at Quebec.

A case of valuable specimens from California was presented by Miss Freeman.

The Branch now numbers 28 members.

During the year papers were read by the President on *Hemiptera*, on the *Flora* and *Fauna* of the Province of Quebec, on "Voices of the Night," on

Insects injurious to Gardens and Fields, on the Asparagus Beetle (*Crioceris asparagi*) and on the Habits of Insects.

The members were hospitably entertained at the houses of the President and Mr. J. H. Simmons, and also by Mr. and Mrs. Geggie, at "Darnoc," Beauport, where a very enjoyable field-day was held.

At the annual meeting held on the 9th October, 1907, the officers for the coming year were elected as follows:—President, Rev. Dr. Fyles; Vice-President, Mrs. Richard Turner; Secretary-Treasurer, Lt.-Col. Crawford Lindsay; Council, Hon. Richard Turner, J. H. Simmons, Esq., Miss Bickell, Miss Freeman, Miss Hedge.

CRAWFORD LINDSAY,
Sec.-Treasurer.

REPORT OF THE TORONTO BRANCH, 1906-7.

The eleventh annual meeting of the Toronto Branch of the Entomological Society of Ontario was held in the Provincial Museum on Tuesday, June 18, 1907.

The President, Dr. Brodie, was in the chair and the following members were present:

Dr. Brodie, Mr. Williams, Mr. Webb, Miss Blackmore, and several visitors.

The Secretary read the following report:

We have pleasure in announcing a very successful and profitable year's work. Our membership roll is slightly increased, although one or two have dropped out.

In all we have had eight meetings and the average attendance of members has been nine. At all the meetings we have also had a number of visitors.

The papers read during the session have been instructive and entertaining, and some have presented material entirely new; at least to most of the members. Not a few have been illustrated by specimens, charts, and models, which added greatly to the value of the lectures.

LIST OF PAPERS, 1906-7.

1. Snout Beetles, Mr. Cosens.
2. Contributions of the 19th Century to the World's Knowledge, Dr. Brodie.
3. Nuptial Dance of some Insects, Dr. Brodie.
4. A week at Niagara, Mr. Williams.
5. An Early Writer on Entomology, Mr. Cosens.
6. Ancestors of Insects, Dr. Walker.
7. Insect Mimicry, Dr. Brodie.

Publications have been received from Ottawa and Washington, from the Ohio and Connecticut Experiment Stations, and from New York State Museum at Albany; and a donation of some Toronto beetles from Mr. Arthur Reston.

The Treasurer reported a balance in hand of $5.55.

The following officers were elected: President, Dr. Brodie; Vice-President, Dr. Walker; Secretary-Treasurer, Miss Blackmore; Librarian and Curator, Mr. Williams; Council, Mr. Hahn, Mr. Webb, Dr. Abbott, Mr. Ivy.

An excursion was made to Niagara Glen on June 8th. About 15 people went, and some very interesting collections were made, especially of shells.

E. BLACKMORE,
Secretary.

TREASURER'S REPORT.

For the Year ending August 31st, 1907.

Receipts.		*Expenditure.*	
Balance on hand Sept. 1, 1906.	$ 523 75	Officers' Salaries	$225 00
Members' fees	399 38	Annual Report	206 75
Legislative Grant	1,000 00	Printing Account	909 08
Sales of pins, cork, etc.	46 01	Expense account, postage, etc.	72 76
Sales of Can. Entomologist	203 81	Purchase of pins, cork, etc.	17 31
Advertising	16 00	Library	12 60
Bank Interest	6 66	Insurance of library and collections	26 00
Refund for rent in London	10 00	Expenses of annual meeting.	95 38
		Balance	640 73
	$2,205 61		$2,205 61

S. B. McCready,
Treasurer.

Examined and found correct this 25th day of October, 1907.
(Signed) J. W. Crow *and* B. Barlow, *Auditors.*

REPORT OF LIBRARIAN.

During the year ending August 31st, 1907, there have been added to the Library twenty-two bound volumes and a large number of periodicals, bulletins and pamphlets; a considerable portion of these will be bound up into permanent volumes during the next few months. Among the new books may be mentioned Folsom's Entomology, with reference to its Biological and Economic aspects; Sir George Hampson's Catalogue of the Noctuidæ in the British Museum, vol. vi.; and Barker's Anatomical Terminology.

48 volumes have been taken out by members during the year and the library has also been made use of for reference and consultation.

Respectfully submitted,
Charles J. S. Bethune,
Librarian.

CURATOR'S REPORT.

During the past year the Curator's work has consisted chiefly in the general care of the Society's collections, the inspecting of the cabinets for pests from time to time, and the placing in the cases of new specimens contributed by members of the Society. In addition to the general work the collections have been gone over and lists prepared of species particularly wanted to fill gaps and replace old and imperfect specimens in the Society's cabinets. These lists will be furnished to members of the Society and it is hoped that all members having spare specimens of the listed species will forward them to the Curator, with date and locality labels attached, in order that the Society's collection may be made as complete and perfect as possible.

Since the last report the following contributions have been made to the collections and our sincerest thanks are due to the generous contributors:

8 specimens of Lepidoptera by Dr. Fletcher, Ottawa; 2 specimens of Coleoptera by J. D. Evans, Trenton, Ont.; 2 specimens of Lepidoptera by C. H. Young, Ottawa; a large collection of Canadian and exotic Coleoptera by Henry S. Saunders, Toronto; 2 specimens of Lepidoptera by J. H. Cook, Albany, N.Y.; 2 specimens of Coleoptera by E. J. Zavitz, O.A.C., Guelph; over 200 species of Lepidoptera by F. H. Wolley Dod, Millarville, Alberta; 50 specimens of Lepidoptera by Charles R. Eby, Washington, and an extensive collection of Insect Galls by T. D. Jarvis, O.A.C., Guelph.

Since the Society's cabinets were installed in the Biological Building at the College, the collections have been constantly accessible to visitors and have been made great use of by the members of the Entomological Department to illustrate lectures and as an aid in the determination of the species submitted to the Department for identification. They have also been a great help to Third and Fourth Year students in naming specimens in the collections which they are requested to make as a part of their work in Entomology.

Respectfully submitted,

J. E. HOWITT, *Curator.*

REPORT TO THE ROYAL SOCIETY OF CANADA.

The following is the report to the Royal Society of Canada from the Entomological Society of Ontario, through Mr. A. F. Winn, Delegate.

The most important event in our Society, during the past year, was the transferring of headquarters to Guelph from London, where they were established in 1872. This change was found necessary owing to the dying out of interest in Entomology in London, and Guelph was selected as being the place most suitable to secure the best interests of the Society, as well as being in accordance with the wishes of the Ontario Department of Agriculture. Aside from the fact that the Society already had a flourishing branch there with a large list of members, at the Agricultural College attendance at lectures in Entomology is compulsory for students in the second and third years, while in the fourth year some specialize in the subject and naturally become active members of the Society and thus ensure a continuity of work and interest.

The collections of books and specimens were moved without any damage whatever. The cabinets of specimens are now conveniently arranged for reference in a portion of the College Museum set aside solely for them. The books and pamphlets, which form a valuable collection of over 1,800 volumes are in a series of stacks in the fireproof Massey Hall Library Building, and are kept entirely distinct from the general library of the College.

Our magazine, "The Canadian Entomologist," has been issued regularly early every month. The 38th volume comprises 425 pages with four full page plates, and 48 figures in the text. The contributors number 66, spread not only through Canada but the whole of North America, and a few residing in England, the West Indies, and the Hawaiian Islands. Two new genera of insects are described and one hundred and fifty new species as well as a number of varieties.

Life histories of several species of insects are recorded, including among the Lepidoptera, *Barathra curialis* by Dr. Fletcher and Mr. A. Gibson; *Incisalia irus* and *I. augustus* by Mr. John H. Cook; Among the Hemiptera,

Mr. J. R. de la Torre Bueno gives the first full account of the Water-bugs *Belostoma fluminea* and *Ranatra quadridentata*.

The series of articles on Practical and Popular Entomology has been continued and the papers published last year are: The Dragon-flies and Damsel-flies by Prof. Franklin Sherman, Jr.; Household Insects by Prof. Wm. Lochhead; Winter Retreats of Insects by Rev. Dr. Fyles; Some Beetles of early May by Rev. Dr. Bethune; Work for June Caterpillar hunting by Mr. A. Gibson; Mites affecting Farm Homesteads by Mr. T. D. Jarvis; The Oyster-shell Bark-louse by Mr. T. D. Jarvis; The Bean Weevil by Mr. A. Gibson; The Locust Mite by Mr. T. D. Jarvis.

Articles descriptive of new species of Lepidoptera are by Mr. A. G. Weeks, Jr.; Mr. August Busck, Mr. A. Cosens, Rev. G. W. Taylor, Mr. John A. Grossbeck. Coleoptera by Mr. Chas. Schaeffer, and Mr. H. C. Fall. Hemiptera by Dr. E. Bergroth. Diptera by Miss C. S. Ludlow, Dr. M. Grabham, Hon. N. Chas. Rothschild. Hymenoptera by Mr. J. C. Crawford, Mr. Myron H. Swenk and Prof. T. D. A. Cockerell. Orthoptera by Mr. A. N. Caudell. Coccidæ by Mr. R. S. Woglum.

Papers on Classification include Mr. G. W. Kirkaldy's Catalogue of Aphidæ; The Classification of Culicidæ by Prof. S. W. Williston; The Perlidæ by Mr. Nathan Banks; Synopsis of Bees of Oregon, Washington and British Columbia, by Mr. H. L. Viereck and associates; Notes on the classification of the superfamily Miroidæ by Mr. G. W. Kirkaldy.

The following are among the papers on miscellaneous topics: A North American Entomologists' Union by Mr. H. H. Lyman; Records of Orthoptera from the Canadian North-west by Dr. E. M. Walker; The Burrows of Cicindela by Mr. W. T. Davis; A fossil Water-bug by Prof. T. D. A. Cockerell; The snow-fly, Chionea valga by Mr. C. N. Ainslie; Notes on Hemiptera taken near Lake Temagami by Mr. E. P. Van Duzee; Geometrid Notes by Mr. Richard F. Pearsall.

Space has been devoted to records of the meetings of the Branches at Toronto, Guelph, Montreal, Quebec and Vancouver which are all in flourishing condition. The appearance of the new books and pamphlets on Entomological subjects has been promptly chronicled.

The Society has, as usual, furnished the Ontario Department of Agriculture with an account of its annual meeting, and a number of articles of popular and economic nature. These have just been published under the well-known title of The Annual Report of the Entomological Society of Ontario. Report 37 contains 120 pages illustrated by 6 beautiful half-tone plates of insect galls found on plants of various kinds, 36 cuts in the text and a portrait of our last year's President, Mr. John D. Evans. Among the papers may be mentioned: Parasitism of Carpocapsa pomonella, (the Codling Moth), by Dr. Brodie; A Hunt for a Borer by Mr. H. H. Lyman; Insect Galls of Ontario, by Mr. T. D. Jarvis; Hemiptera, by Rev. Dr. Fyles; Injurious Insects of 1906 in Ontario, by Rev. Dr. Bethune; Basswood, or Linden, Insects, by Mr. A. Gibson; Insects Injurious to Ontario Crops in 1906, by Dr. James Fletcher.

Dr. Fletcher's Entomological Record for 1906 requires 19 pages, is full of notes on the occurrence and distribution of the rarer species of Canadian insects, and becomes each year more valuable.

In conclusion your Delegate drew attention to the fact that the much dreaded Brown-tail Moth had established itself in Nova Scotia and hoped that immediate and thorough action would be taken to rid the country of an insect, which, if allowed to breed without check would prove disastrous to the far famed apple orchards of the Annapolis Valley.

During the remainder of the morning and in the afternoon the following papers were read and briefly discussed: "Further notes on Hepialus Thule at Montreal" by Mr. H. H. Lyman, and "Notes on Collecting Sthenopis (Hepialus) Thule at Montreal" by Mr. E. Denny. (These two papers are published in the *Canadian Entomologist* for December 1907). "The Two-winged Flies of the Province of Quebec" by the Rev. Dr. Fyles; "The Scale Insects of Ontario," illustrated by a large number of specimens, by Mr. T. D. Jarvis; "An Unusual Outbreak of Halisidota Caterpillars" by Mr. Arthur Gibson; "A Remarkable Outbreak of the Variegated Cut-worm" by Prof. Bethune and Mr. L. Caesar; "Insects Injurious to Ontario Crops in 1907" by Dr. James Fletcher; "Insects of the Season, 1907" by Prof. Bethune; "The Entomological Record for 1907" by Dr. Fletcher. The session was brought to a close with the Presidential Address of Dr. Fletcher on "The Entomological Outlook in Canada." These papers will be found in subsequent pages of this report.

In the evening an illustrated lantern lecture was given in Massey Hall by Dr. E. M. Walker of Toronto, on collecting and rearing Dragon-flies, after which votes of thanks were accorded to President Creelman, the local officers of the Society and the lecturers. The meeting then adjourned.

COLLECTING AND REARING DRAGON-FLIES AT THE GEORGIAN BAY BIOLOGICAL STATION.

By E. M. Walker, M.D., Toronto.

During the summer of 1907, I spent two months at the Freshwater Biological Station, Georgian Bay, Ont., and there had good opportunities for studying the aquatic insect life, especially the Dragon-flies, which were particularly abundant both in species and individuals and to which a considerable amount of time was devoted.

In this work I was ably assisted by W. J. Fraser, who also continued the work for about three weeks after I left, and to whose keen observation and enthusiasm much of the credit of the work is due.

The Georgian Bay Biological Station, whose site is on one of the numerous islands about the entrance to Go Home Bay affords the entomologist almost ideal conditions for the study of aquatic insect life, combining as it does the advantages of a laboratory equipment with those of extremely varied natural surroundings in which a great many different kinds of aquatic environments are represented.

In addition to the laboratory building, the Station is provided with a dwelling house for the use of its working staff, a store-house for material, a tank and pumping engine to supply the laboratory with running water and a boathouse supplied with several small boats, fishing-nets and other collecting apparatus. The laboratory building is situated close to the water's edge and has an ample floor space of 20 x 40 ft., divided into a large general laboratory and 4 small rooms, used respectively as photographic, chemical, glassware and private rooms. The laboratory affords working space for 12 students and in its centre is a long aquarium table supplied with running water from the tank so that it is possible to keep under observation animals, such as fish-embryos or the inhabitants of rapid streams which soon die or at least do not thrive in an ordinary aquarium.

In view of its connection with the Department of Marine and Fisheries the work of the Station is primarily concerned with problems relating to pisciculture, such as the spawning habits of the various food fishes and the

natural history of the smaller forms of life upon which they feed. In this connection a knowledge of the life histories of the aquatic insects is of considerable importance, forming as they do a large part of the food of some of the fish. The food of the brook-trout for example as Prof. Needham has shown (Aquatic Insects in New York State, Bulletin 68, N.Y. State Museum) consists almost entirely of certain aquatic insect larvæ, particularly those of a certain Chironomid fly, while other small dipterous larvæ, caddis worms, etc., contribute a considerable proportion.

At Go Home Bay we frequently found the stomachs of the common sucker filled almost exclusively with the full-grown nymphs of the large May-fly (*Hexagenia bilineata*) which breeds in enormous numbers in the bays and channels in that locality, and many other instances could be given of insects forming an important part of the food of fish.

A considerable portion of the two months which I spent at the Station was accordingly devoted to this branch of the work, most attention having been given to the Dragon-flies, as the group with which I was most familiar and one which was very abundantly represented there.

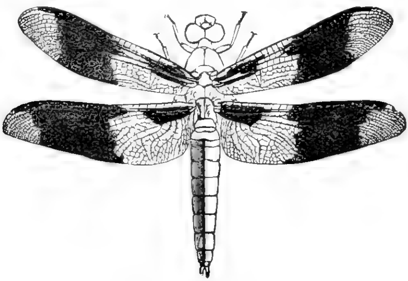

Fig. 4. Dragon-fly.

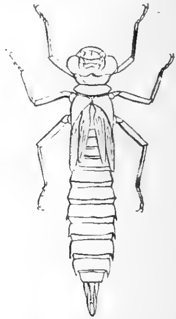

Fig. 5. Nymph.

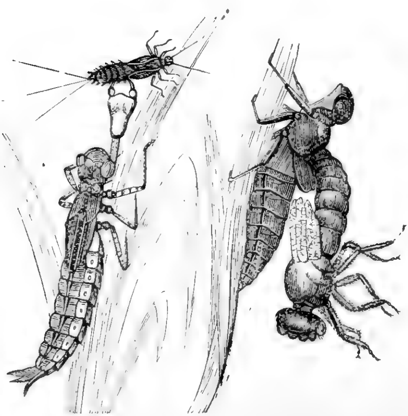

Fig. 6. Larva seizing its prey and the Dragon-fly emerging from the Nymph.

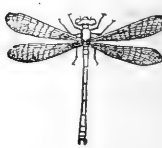

Fig. 7. Damsel-fly.

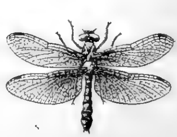

Fig. 8. Nannothemis bella.

Life-History of Dragon-flies.

All Dragon-flies (Fig. 4.) are aquatic in their early stages and all inhabit fresh or occasionally brackish water. The eggs are deposited by the female upon various aquatic plants or freely upon the surface of the water, either singly or in clusters of varying size, sometimes enveloped in a gelatinous mass like those of snails or frogs. On hatching the young nymphs at once begin the active predaceous life which is characteristic of the whole tribe. They feed upon all kinds of small aquatic life, such as other aquatic insects, snails, tadpoles, or even small fish, which they grasp by means of a pair of hooks at the end of the enormously developed labium. This structure when at rest is folded under the head, concealing the mouth-parts like a mask, but when a small insect or other suitable animal chances to pass near by, it is suddenly thrust out with lightning speed and the victim drawn back within reach of the powerful mandibles (Fig. 6.). The length of the nymph's life varies greatly in different species, sometimes 3 or 4 years being required to reach maturity. When ready for transformation the nymph crawls out upon some suitable support such as a rock, reed or log, the choice of this support and its distance from the water's edge varying in different species (Fig. 6). In a few minutes the thorax begins to bulge, the skin splits along the median line and across the head, and the insect gradually emerges, the thorax appearing first, then the head, wings, legs and finally the abdomen; the latter is at first comparatively short and stout but rapidly elongates and at the same time the wings expand. The coloration is at first very pale and indefinite and it generally requires at least a day before it is fully mature.

Transformation usually takes place early in the morning and hence this is an excellent time for collecting material, for one can often get the imagoes of good species, together with the exuviæ of their nymphs, which retain the form of the latter perfectly and are therefore invaluable as specimens. The imagoes with their exuviæ are best collected in paper bags, in which they can be kept until the colors have matured.

Nymphs (Fig. 5.) of different species inhabit different aquatic environments and all such should be thoroughly searched. The best apparatus for general collecting is the sieve-net devised by Prof. Needham (Bull. 39, U.S.N.M.). This is a deep galvanized iron tray with a bottom of galvanized wire-screen. It can be made like a rake as a combination of net and sieve.

Most nymphs are easily reared in ordinary aquaria though some require running water. We used large, glass jars, covering the top when necessary with cheese cloth. A quantity of the rubbish in which the nymphs naturally live should be placed in the water and a few branches or boards for them to crawl out upon at the time of transformation. A sufficient quantity of aquatic plants must be used to keep the water fresh and the rubbish containing the nymph's food changed once a week.

As already observed the natural conditions which obtain in the vicinity of Go Home Bay are very well adapted to the study of aquatic insect life. Lying at the mouth of the Go Home River, one of the outlets of the Muskoka Lake system, it is within easy reach of a variety of different kinds of aquatic environment, representing all the transitions from the open lake to the sheltered river system. There are the rocky islands and reefs in the open lake, wind-swept and wave-tossed and either wholly barren of vegetation or affording but a scanty sustenance to a few stunted pines, junipers and other hardy plants in the crevices of the rocks, while further inland there are the deep quiet waters of the bay with numerous wooded islands,

and finally the moving water of the Go Home River. Then at many points along the irregular shores of the mainland and the larger islands, shallow inlets with sandy or gravelly bottoms and a luxuriant aquatic and shore vegetation support a widely different fauna from that of the more exposed parts, while finally there are numerous small inland lakes, which again present conditions quite distinct from any of those already mentioned. Their shores are sometimes rocky and bare in places but are for the most part swampy; floating sphagnum bogs being a special characteristic of the margins of these lakes. These are often gems of natural beauty and are of great interest to both zoologists and botanists on account of the many rare and interesting forms, mostly of a boreal character, which are met with here.

The first collecting trip after my arrival at the Station was made on June 16th to one of the larger of these enclosed lakes. The black flies were so tormenting that collecting, especially in a sheltered spot like this, was by no means a pleasure and even in the more exposed islands their numbers were sufficient to cause us considerable annoyance. But few dragon-flies were as yet abroad and these had for the most part not yet attained their mature coloration. *Libellula exusta*, Say., was the most abundant and continued to be so throughout a large part of the season. It is not common with us at Toronto but here, particularly during July, was extraordinarly numerous everywhere in the woods, but especially about these lakes and in the shallow swampy inlets. The female is inconspicuously colored but the males have their bodies covered in part by a bluish-white bloom which renders them very conspicuous when chasing each other over the water or resting on the rocks and logs. We found the nymphs of next year's brood in large numbers in the red-rotten vegetation at the bottoms of these lakes and the exuviae where commonly found adhering to the sedge and grass near the water's edge.

Another Dragon-fly of very different structure and appearance but frequenting the same sort of waters, is *Gomphus spicatus*, Selys. This was also met with on our first trip in considerable numbers and continued to emerge for some days afterwards. It belongs to a group whose nymphs are burrowers and in accordance with such habits are more or less flat with legs adapted for digging. They live in the silt at the bottom of lakes, ponds and streams, the tip of the elongated abdomen being held above the surface for breathing purposes. The imagoes, like most species of the genus, are dark brown with yellow bands and spots, rather small, widely separated eyes and a more or less club-shaped abdomen in the male. They also have the characteristic Gomphine flight, which though swift is generally very short, the insect constantly alighting, usually upon flat ground, seldom perching upon twigs after the manner of Libellulines. *G. spicatus* became very abundant at Go Home but like most of its congeners it is comparatively short-lived and by the middle of July has almost disappeared.

A third species of which only freshly emerged examples were taken on this date was *Leucorhinia frigida*, Hag., a small Libelluline of distinctly northern distribution which is quite absent from the fauna of southern Ontario. It became one of the most abundant Dragon-flies at Go Home Bay and was especially characteristic of the small lakes, while our common southern species *L. intacta*, Hag., was but rarely met with. Its nymphs had never been found before, but we obtained them in large numbers and reared them without difficulty.

Four other species were also taken on this date, two common little Damsel-flies or Agrionidae, the little blue *Enallagma Hageni* (Walsh)

and the wide-spread *Ischnura verticalis* (Say), that familiar little green and black species with the blue-tipped abdomen; and two species of *Tetragoneuria*, the common *semiaquea* (Burm.), and the larger and more northern *spinigera* (Selys.). The former is common everywhere in southern Ontario, but I have never seen them in anything like such large numbers as they appeared at Go Home Bay, especially about the last week in June, when on hot still days they positively swarmed in favorable spots. They breed most abundantly in the little marshy coves along the shore, and here the exuviae were sometimes so numerous that a single reed or grass stem would bear half a dozen of them.

Next day we went to the 'Chute,' a waterfall a short distance up the river. Here two other dragon-flies not often taken by the ordinary collector were found. These were *Didymops transversa* (Say), and *Basiaeschna janata* (Say.). The former is a brown insect with clear wings, the abdomen transversely banded with pale yellow and distinctly club-shaped in the male, while the latter is closely related to the various members of the genus Aeschna, those large dragon-flies with blue-spotted bodies that are so common in late summer. Both of these forms have the habit of following the shores of the lakes and streams in a regular beat so that if one stations one's self at some point along their course, one has a fair chance of capturing them as they pass by sweeping the net at them from behind.

The nymph *transversa* is a very curious spider-like creature with a round abdomen and long sprawling legs which clambers about the rocks along the shores of the bay and when ready to transform usually crawls several yards at least from the water's edge. The only other Canadian species allied to it also appeared at Go Home, but later in the season, namely about July 4, when *Didymops* had already disappeared. The nymph of this species (*Macromia Illinoiensis*, Walsh) closely resembles that of *Didymops* but the imago is a much larger and finer insect, a splendid dragon-fly, black with a conspicuous yellow spot on the upper side of the abdomen and the sides of the thorax metallic green with an oblique yellow stripe. It has also superb aerial powers and great patience and determination is required to get many specimens.

Towards the end of June new dragon-flies were constantly making their appearance. On the Station Island, which lies partly well out toward the open bay, three species of Gomphus appeared about this time, *G. sordidus*, Selys., a large species, much resembling *spicatus* but quite different in habitat, appeared in great numbers, the nymphs crawling out from among the boulders along the shore and transforming upon the rocks close to the water's edge. In a few days the islands were covered with them but they were very short-lived, the great majority having disappeared by the first week in July. A few specimens also of *G. brevis* (Selys.), a short thick-set form, appeared about the same time but were found to be more characteristic of the rapids of the river, while a few days after the first *sordidus* emerged, *G. exilis* (Selys.), appeared, soon increasing greatly in number and showing a much wider choice of habitat than either of the others. While *spicatus* and *sordidus* were only accidentally found together, *exilis* was commonly associated with both of them. The food of these Gomphines seems to consist chiefly of May-flies, which are so abundant during their season of flight and which likewise disappear so suddenly.

More interesting than any of these, however, was the discovery of *Neurocordulia yamaskanensis* (Prov.), a species originally described from Mount Yamaska, Quebec, by L'Abbe Provancher, but which has been taken by very few collectors since then. Several years ago I obtained a number of nymphs and exuviae, of a kind unfamiliar to me, in Algonquin

Park, which were referred by supposition to this insect, as they clearly belonged to the same genus as *N. obsoleta* (Say.), the only other regional species and whose nymph was already known. This summer I had the good fortune to come upon the same kind of exuviae upon the timbers of the wharf at Go Home, where they had evidently emerged from water of considerable depth, 5 or 6 feet at least. Further search revealed others on the steeper parts of the rocky shores and on June 28th a special hunt for the emerging imagoes was made in the early morning. After protracted search, when we had almost come to the conclusion that their time for transformation was over, one was at last found in a wide crevice accompanied by its exuviae, and on subsequent occasions several more were obtained.

No imagoes could be found on the wing, however, and it became a subject of conjecture to us what became of them. One evening, however, some time after sunset, Mr. Fraser made the discovery that they were flying about the island in pursuit of May flies. Since then we took them repeatedly at almost the same hour, but at no time during the day were they ever seen upon the wing, except when started from a bush or tree where they were resting. This is the only case I know of a strictly crepuscular dragon-fly though several diurnal species, such as the Aeschnas, are known to fly until dusk.

Several other forms belonging to this same group of Cordulinae were met with but the only ones which occurred in large numbers besides the *Tetragoneurias* already alluded to, were the dainty and beautiful little *Dorocordulia libera*, (Selys.) and the large and striking *Epicordulia princeps*, (Hag.). The former with its delicate form and slender waist, its vivid emerald green eyes and dark metallic green body is one of our most exquisite dragon-flies. Its nymph is an inhabitant of the swampy inlets and boggy margins of the enclosed lakes, and here the imagoes may be found coursing up and down over the water or the bog, with the abdomen tilted up in a peculiar way, or sunning themselves upon the leaves along the shore.

Epicordulia princeps, (Hag.) is a species of more southern distribution and hence more often seen in collections. It is peculiar among Cordulines in having the wings spotted after the manner of some of the common Libellulae, but is readily distinguished from these on the wing for it is a much more restless insect, flying ceaselessly over the larger bodies of water often at considerable heights, but also common enough in the rocky open woods some distance from the shore. It was a very characteristic species about Go Home Bay from the last week in June until about the middle of August.

The largest and most striking of all the dragon-flies of the region, however, has not yet been mentioned. This is a great black and greenish-yellow Gomphine, *Hagenius brevistylus*, (Selys.) which suddenly appeared on the Station island and elsewhere in considerable numbers. Its great size, striking coloration and the peculiar way in which the abdomen is curved downward in flight renders it a formidable-looking insect on the wing, while its nymph is a most gorgeous creature very different in appearance from other Gomphines. It is a large flat brown insect with a nearly circular abdomen looking more like a gigantic bed-bug than anything else. They live among the roots and debris along the lower and more sheltered parts of the shore, always, however, where there is considerable wave-action or current. The few nymphs we found before their time for transformation began died in confinement, the water in which they were kept not having been sufficiently well aërated.

Numerous other dragon-flies were taken and the nature of their breeding places more or less definitely determined, but time does not permit me to mention more than a few of these.

The greatest rarity was *Nasiaeschna pentacantha* (Ram.) of which probably less than twenty specimens exist in collections, although it is distributed as far south as Texas and has been known a long time. Last year Mr. Fraser obtained three specimens of its peculiar nymph near Bala, Muskoka. This is a large sluggish dark-brown creature of apparently similar habits to those of *Hagenius* but entirely different in appearance. This summer I accidently found a nymph clinging to my paddle while passing through a short channel which leads into one of the small lakes. Further search for nymphs proved fruitless but a few days afterwards a few imagoes were seen on the wing over a marsh on the border of the same lake, but were too wary to be netted. About a week later, however, I chanced upon a similar spot in another locality and managed to net a fine male, and this was the only one taken as the season was apparently about over.

Another somewhat rare species and a very odd and interesting little one is *Nannothemis bella* (Uhl.) Fig. 8. This is a very tiny dragon-fly, though it belongs to the Libellulidae which are mostly large forms, whereas all the rest of our very small species belong to the Agrionidae or Damsel-flies. The male, which is at first perfectly black, very soon becomes covered with a bluish dust, while the female is black with transverse bands of yellow. It was only found in two places but at one of these it was exceedingly abundant. This was a small floating sphagnum bog occupying one corner of an enclosed lake and having an area of scarcely 50 square yards. Here they were flying about among the grass and bog plants close to the ground and when perching had the peculiar habit of folding the wings downwards on each side of the stalk which formed their support. This spot was a veritable little garden of orchids and other interesting plants. Over the sphagnum moss the cranberry vines trailed in the greatest profusion, while pitcher-plants, sundews of two kinds, the delicate rose-colored orchids, *Pogonia ophioglossoides* and *Limodorum tuberosum*, and the tufts of white cotton-grass were a most charming spectacle. It is among the roots of the cranberry-vines and sphagnum that the nymphs of *Nannothemis* live, these being well immersed in water. We could not find any, however, and two exuviae were the only reward of a most careful search. This bog and others of the same kind were the home of many other dragon-flies, but I shall make mention of only two or three of the Damsel-flies or Agrionidae (Fig. 7), a large group which I have as yet scarcely alluded to. Some 18 species were taken in the vicinity of Go Home Bay, two of which were new to Canada. These Agrionids are the small delicate forms that flit about in such large numbers among the grass and sedge about the margins of lakes and streams. One of the smallest of our species *Nehallennia gracilis*, Morse, and a new addition to the Canadian fauna, we found in vast numbers in every sphagnum bog. It is an exceedingly delicate little bronze-green insect, the under parts yellowish-green and the end of the abdomen beautifully tipped with pale blue, and very closely resembles the common species *N. irene*, which, however, has different haunts, preferring the shallow marshy inlets of the bay to the bogs of the small lakes.

The most familiar members of this group, however, are the beautiful little azure-blue *Enallagmas* and the larger, dark metallic-green forms with broad black or banded wings belonging to the genus *Calopteryx*. *Enallagma* was abundantly represented by 8 species, but *Calopteryx* of which *C. maculata* is familiar to every collector was exceedingly rare, it being a frequenter of woodland streams of which there were very few in the district.

Lestes is another large genus of this group and was conspicuously represented at Go Home, the large and graceful *L. vigilax* being particularly numerous in all marshy places. These forms are slender, graceful insects, generally bronze in color and are easily recognized in the field by the listless way they have of resting upon a grass stem or reed with the wings half spread. Other Agrionids keep their wings folded together over the back, while in the rest of the dragon-flies they are held in a horizontal position.

These *Lestes* are among the later dragon-flies to appear and are common until well on in September, when almost the only other survivors of the group are the *Aeschnas* and the various species of *Sympetrum*, those hardy little red fellows which are so abundant in late summer and fall. The dragon-fly season, in fact, begins to wane before the end of July, though a host of forms are still abroad in August and several species do not appear until the month has begun. We have, however, dealt with a sufficient number to indicate the nature of this part of our summer's work at the station and the character of the fauna in that region. Fifty-eight species were taken and the nymphs or nymph exuviae of nearly half that number, and it is to be hoped that the work will be continued year by year until the life histories are known not only of the dragon-flies but of all the aquatic insects of the region.

A PRELIMINARY LIST OF THE SCALE INSECTS OF ONTARIO.

By Tennyson D. Jarvis, B.S.A., Ontario Agricultural College, Guelph.

The following list of 48 species is certainly not a complete one for our province, but may serve as a basis for further work by other collectors. Twenty-eight of these are found on forest trees, 8 on fruit trees, 10 on shrubs, 9 on greenhouse plants, 2 on weeds, 2 on staple crops, and 1 in nest of ants.

I am deeply indebted to Prof. J. G. Sanders and Prof. C. L. Marlatt, Bureau of Entomology, Washington, for identification of many of the species. I owe thanks to Mr. L. Caesar for his assistance in describing many of the insects. To the following, also, my gracious acknowledgment is due for assistance in various ways: Dr. Bethune, O. A. College; Dr. Fletcher, Dominion Experimental Farm, Ottawa; Prof. C. C. James, Thomas Rivett and Percy Hodgetts, Department of Agriculture, Toronto. Many of the illustrations are after Lochhead (the San José Scale and other scale insects).

Ortheziinæ.

(Arranged according to a Catalogue of Coccidæ of the World, by Mrs. Fernald.)

90 Orthezia Americana, (Walk)—Artemisia sp., Woodstock.
98 Orthezia insignis, (Dougl.)—Palm, Greenhouse, Toronto.

Dactylopiinæ.

192 Asterolecanium variolosum, (Ratz.)—Oak, (Quercus sp.)—Niagara, Ottawa.
254 Kermes Pettiti, (Ehrh.)—White Oak (Quercus alba), Toronto.

255 Kermes pubescens, (Bogue)—Bur Oak (Quercus macrocarpa)—Guelph, Perth, Toronto.
279 Gossyparia spuria, (Modeer)—American Elm (Ulmus americana)—Toronto.
391 Phenacoccus aceris, (Sign.)—Soft Maple (Acer saccharinum), Amherstburg, Ont.
401 Phenacoccus Dearnessi, (King)—Hawthorn (Cratægus sp.), London.
454 Pseudococcus citri, (Risso)—Many species of plants, greenhouse, Ont.
490 Pseudococcus longispinus, (Targ.)—Many species of plants, greenhouse, Ont.
529 Pseudococcus trifolii, (Forbes)—Clover roots (Trifolium repens)—Collingwood.
572 Ripersia lasii, (Ckll.)—Nests of ants, Toronto.
699 Pulvinaria vitis (L.), (Rathvon)—Acer sp., Salix sp., Ilex verticillata, Cratægus sp., Tilia americana, Viburnum pubescens, Western Ontario.
661 Pulvinaria floccifera, (Westwood)—Brassia sp., greenhouse, Ottawa
848 Coccus hesperidum, (Linn.)—many species of greenhouse plants, greenhouse, Ont.
860 Coccus pseudohesperidum, (Ckll.)—Cattleya, greenhouse, Guelph, Ottawa.
959 Eulecanium quercifex, (Fitch.)—Red Oak (Quercus rubra), Jubilee Point, Lake Ontario.
918 Eulecanium caryæ, (Fitch)—Am. Elm (Ulmus americana); Hawthorn (Cratægus sp.)—Guelph, St. Catharines.
921 Eulecanium cerasifex, (Fitch)—trees, shrubs and vines of all kinds. All parts of settled Ontario.
935 Eulecanium Fletcheri, (Ckll.)—White Cedar (Thuja occidentalis), Guelph, Ottawa.
950 Eulecanium nigrofasciatum, (Perg.)—Soft Maple (Acer saccharinum), St. Catharines, Walkerville.
902 Toumeyella pini, (King)—Austrian Pine (Pinus Austriaca), London.
Toumeyella liriodendri, (Gmel.)—Tilia Americana, Ottawa.

DIASPINÆ.

1036 Chionaspis Americana, (Johnson).
1055 Chionaspis furfura, (Fitch)—Pyrus, Cratægus, Ontario.
1062 Chionaspis Lintneri, (Comst.)—Alder (Alnus incana), Dogwood (Cornus stolonifera), London, Guelph, Rondeau, Ottawa.
1073 Chionaspis pinifoliæ, (Fitch)—Pinus and Picea, Ontario.
1081 Chionaspis salicis, (Linn.)—Leatherwood (Dirca palustris), White Ash, (Fraxinus americana), Guelph.
1096 Aulacaspis Boisduvalii, (Sign.)—Palm, greenhouse, Guelph.
1127 Aulacaspis rosæ, (Bouche)—Rose, Raspberry, etc., Ontario.
1143 Hemichionaspis aspidistræ, (Sign.)—Pteris serrulata, Ottawa.
1199 Aspidiotus æsculi, (Johnson)—Tilia americana, Toronto, Brantford, Guelph.
1200 Aspidiotus ancylus, (Putn.)—Weeping Willow, Am. Elm, Belleville, Ottawa, Toronto, St. Catharines.
1220 Aspidiotus diffinis, (Newst.)—Basswood (Tilia americana), Guilds.
1229 Aspidiotus Forbesi, (Johnson)—Beech, Fragrant Currant, Apple, Plum and Hawthorn—London, Ottawa, Niagara District.
1233 Aspidiotus hederæ, (Vall.)—Oleander, etc., greenhouse, Ontario.
1239 Aspidiotus juglans-regiæ, (Comst.)—Apple, Willow, Cottonwood, Niagara, Collingwood.

1250 Aspidiotus Osborni, (Newell and Ckll.)—Quercus alba, Betula lutea—Guelph, Toronto.

1252 Aspidiotus ostreæformis, (Curt.)—Apple, Pyrus, Maple, (Acer saccharinum, Hawthorn, Ontario.

1256 Aspidiotus perniciosus, (Comst.)—Apple, Pear and many shade trees—Niagara district, London, Aylmer, Essex district.

1270 Aspidiotus ulmi, (Johnson)—Ulmus americana—Guelph, Toronto.

1300 Chrysomphalus dictyospermi, (Morg.)—Cinnamon, greenhouse, Ottawa.

1305 Chrysomphalus obscurus, (Comst.)

1330 Targionia Dearnessi, (Ckll.)—Arcostaphylos uva-ursi, Bruce Peninsula, Shores of Lake Huron.

1377 Lepidosaphes Beckii, (Newm.)—imported oranges and lemons.

1431 Lepidosaphes ulmi, (Linn.)—many species of trees, Ontario.

1442 Parlatoria Pergandei, var. theæ, (Comst.)—lemon, O.A.C. greenhouse.

The San José Scale, *Aspidiotus perniciosus*, (Comst.), figs. 10-14.

Wherever it occurs the San José Scale is considered, and rightly so, the most destructive insect that fruit growers have to combat. Fortunately for us, however, in Ontario it is confined to the south-western portion of the province.

The mature female scale is small, circular, 1-2 mm. in diameter, only slightly convex, grayish brown in color except the central part, which is often of a lighter shade, being usually a light yellowish-brown color. The exuviæ or larval skin is centrally situated, or nearly so. The surface is fairly smooth. Sometimes a sooty fungus (*Fumago salicina*) darkens the color of the scale.

The male scale is much smaller and different in shape. It is oblong instead of circular, and about twice as long as broad, but the total length is only about half the diameter of the female. The exuvial part is not central, but situated near one end. The color as a rule is considerably darker than that of the adult female.

The usual appearance of the wintering stage of the female scale is different from the summer form, being very small, almost black and circular, with exuvial part central. There is a distinct nipple with a ring or depression around it.

There are four other Aspidiotus scales found in Ontario which are very difficult to distinguish from the San José scale. The particular points of difference between each of these and the San José scale will be discussed as these scales are respectively taken up. It should be noted, however, that if one takes his knife and cuts off a slice from a twig or branch affected with San José scale the cambium and some of the sap-wood just beneath the bark will be seen to be colored purple. This purplish color is very often seen also on the surface of the bark, and on the fruit around where the scale is situated.

Though the scale insects are in all stages when winter comes on, yet by far the majority of the females are of the type described above under the heading of the wintering stage. In the spring, about the end of May, though this year not until the middle of June, the winged males come forth and fertilize these half-grown females. About a month after this, the latter begin to give birth to living young. About eight or ten young are born in a day as a rule, and a single female continues to reproduce at this rate for about six weeks, when she dies. A young female takes about forty days to mature and then in turn begins to produce living young. In this way we find that all stages of the insects are to be found all through the summer until the frost stops the reproduction. So very prolific is the insect that it has been calculated that if every scale were to live and mature, 3,000,000,000 individuals could be traced back to a single fertilized female in one summer. Hence it

is easy to understand why the scale so quickly destroys infested trees. It is usually found that if no steps are taken to check the pest, it will kill young thrifty trees in three years.

Almost any kind of fruit trees and bush fruits are liable to be attacked by the scale. Many shade and forest trees are also attacked.

Remedies.

(1) There is one great standard remedy that has given good satisfaction whenever carefully made and thoroughly applied, namely, the lime-sulphur wash. This should be put on in the spring, or in badly infested orchards it will pay to give the trees a double dose, one in autumn as soon as the leaves fall and the other in the spring before the buds have burst.

(2) Kerosene emulsion, whale oil soap, and a number of other ready-made oil washes, like Scalescide, give fairly good results. They have not, however, been found to be so reliable as the lime-sulphur wash, and in addition are much more expensive.

Before any tree is sprayed it should be carefully pruned and the branches thus removed should be burned.

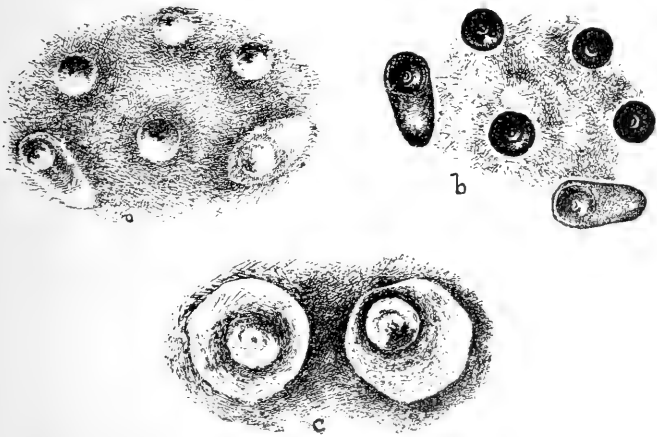

FIG. 10. San José Scale (*Aspidiotus perniciosus*). (*a*) Four young scales and two male scales, showing the nipple and ring even in the very young forms; (*b*) four immature female scales, and two nearly grown male scales, showing the prominent nipple and circular groove about the nipple, of the black scales; (*c*) two small female gray scales, showing the central nipple and circular groove. One scale has a nipple not central. The body of insect is beneath the scale.

Parasites.

(1) Two small Chalcid flies, *Aphelinus mytilaspidis* (Le Baron), and *Aphelinus fuscipennis*, (How.)

(2) Two ladybird beetles, *Pentilia misella*, (Lec.), fig. 15, and *Chilocorus bivulnerus*, (Muls.)

(3) In some districts a fungus ,*Sphærostilba coccophila*. It is difficult to say whether the latter is at work in Ontario.

Note.—At the 1906 meeting of the Entomological Society of Ontario, I gave observations on a scale insect, which I thought to be the San José scale, in gardens at Toronto. Since that time I have made a more careful microscopic examination, and find it to be *Aspidiotus ostreæformis* or Curtis scale. The bark around the scale was pink, much like the appearance of the San José scale infested bark.

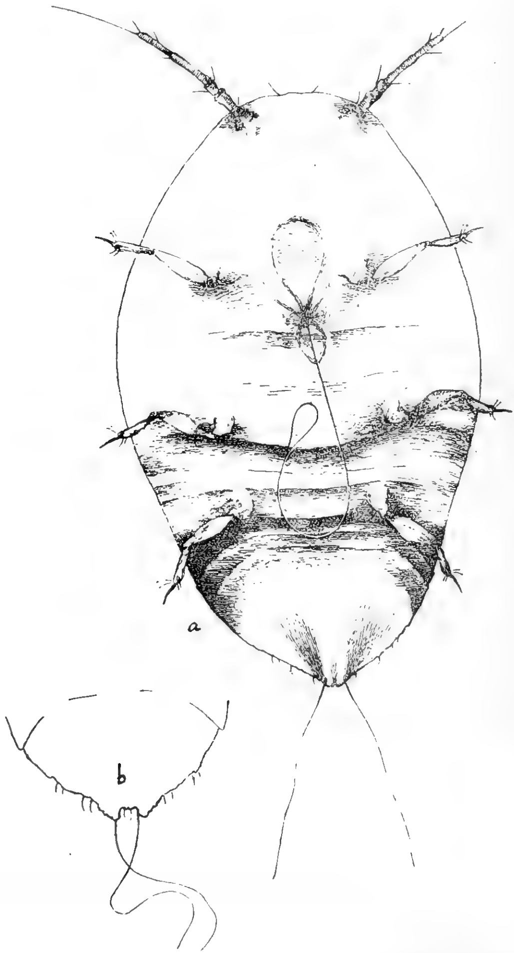

FIG. 11. San José Scale larva, the active crawling form, showing the two feelers, six legs, and long sucking tube; (*b*) enlarged drawing of anal plate.

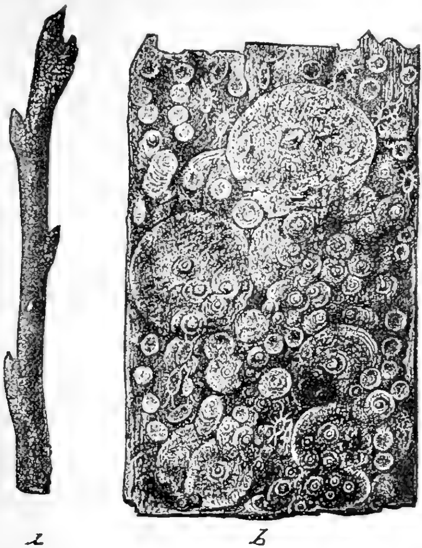

FIG. 12. A portion of branch covered with San José Scale. Appearance of scale on bark; (*a*) infested twig, natural size; (*b*) bark as it appears under hand lens, showing scales in various stages of development and young larvæ.

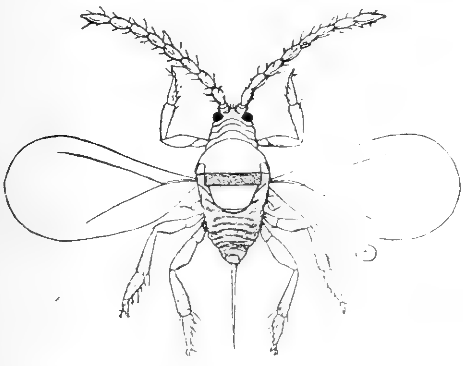

FIG. 13. Adult male insect of San José Scale, escaped from covering scale, showing the two wings, two feelers, two eyes, six legs, and long anal style. (Div. Ent. U.S. Dept. Ag.)

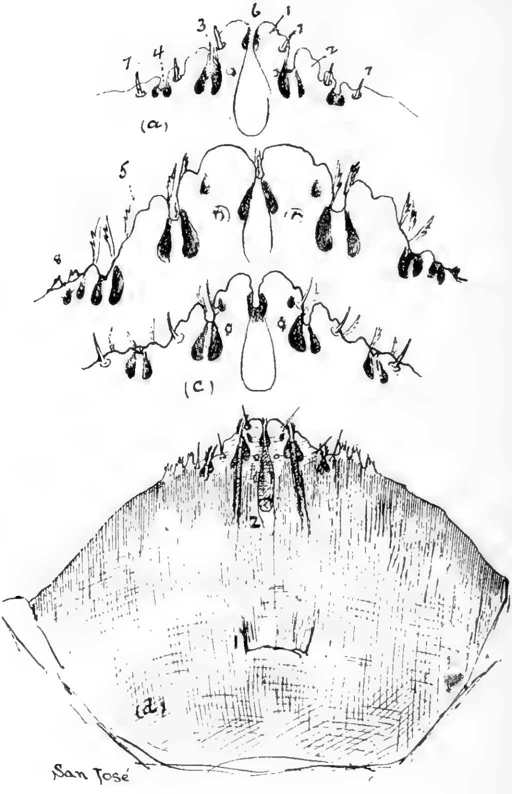

FIG. 14. Anal plates of female San José Scale. (*a*) Anal plate, showing median lobe (1), second lobes (2); incisions (6), (3), (4); chitinous thickenings on each margin of these incisions, and the spines (7) on each of the lobes. (The plates have not been drawn in this case). (*b*) Anal plate, showing the lobes, incisions, thickenings, and plates (5) a pair of plates between median lobes, a pair at first incision, and three at second incision. Notice the large size of second lobe, which is notched once on the margin. (Spines have not been drawn). (*c*) Anal plate, showing both spines and plates. Notice the chitinous thickenings between the median and second lobes are nearly equal in size and close together. (*d*) Anal plate and last segment of adult female. There are no ventral glands. (1) Vaginal opening; (2) anal opening.

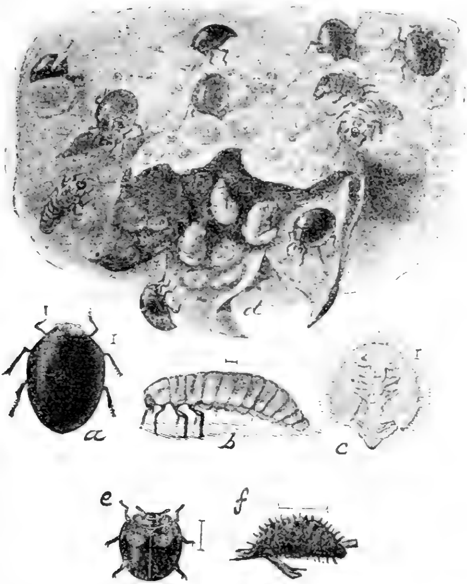

FIG. 15. Two enemies of the San José Scale. (*a*) Beetle; (*b*) larva; (*c*) pupa of Pitiful Lady-beetle (*Pentilia misella*); (*d*) blossom end of pear, showing scales with larva and beetles feeding on them; (*e*) Twice-stabbed Lady-beetle (*Chilocorus bivulnerus*); (*f*) its larva. (*a*, *b*, *c* and *d* after Howard, & Marlatt, *e* and *f* after Riley).

Curtis scale (*Aspidiotus ostreæformis* Figs. 16-18.

This scale is much more widely distributed throughout Ontario than has been hitherto supposed, but in spite of its prevalence, it does not seem to be very destructive.

The adult female resembles the San José in being circular and having the exuviæ centrally situated as a rule, though with many exceptions. It differs, however, in several important particulars: (1) It is considerably larger, averaging about 2 mm. in diameter, whereas the San José averages about 1.4 mm. (2) It is much more convex. (3) A smaller proportion of the exuvial part is light colored, in fact only the nipple, whereas a considerable part of the central portion of the San José was lighter than the general color of the scale. (4) There is a light or whitish colored margin to be seen around the outside of most of the scales. (5) The surface is rougher. (6) The usual winter form is not nearly black like the San José but is a whitish brown, and has no ring or depression around a distinct nipple.

This scale passes the winter in mature condition for the most part. It matures about the end of June. Like the San José it brings forth living young which continue to be produced throughout nearly all of July. There is, however, only one generation in a year.

The scale has been reported to us or found by us in very many places in Collingwood on the west to Trenton in the east.

Its chief food plants in Ontario seem to be the apple and pear. It is said, however, to attack also the plum, cherry, currant, mountain ash, elm, basswood, Carolina poplar, and willow.

Natural enemies:

(1) A white fungus, commonly attacks it at Guelph. See Plate D.

(2) A few of the scales were perforated in a manner characteristic of Chalcid flies, so that it is probably attacked by one of these tiny parasites.

Remedies:

Scrape the rough bark off the trunks of trees and use the same remedies as for San José scale.

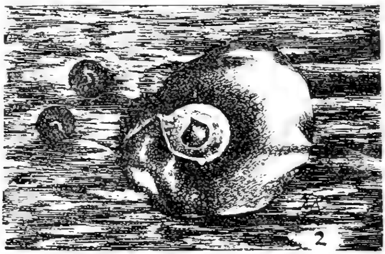

Fig. 16. Curtis Scale (*Aspidiotus ostreæformis*), greatly magnified.

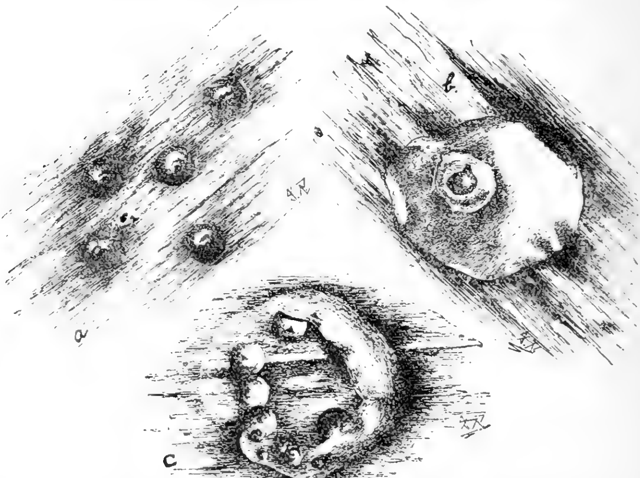

Fig. 17. Curtis Scale (*Aspidiotus ostreæformis*). (*a*) Young scales which are not nearly full-grown; the nipple is plain, but the circular grove about it is wanting; (*b*) Full-grown pregnant female; the nipple is large; (*c*) old scale with several young scales hidden beneath it—a characteristic feature.

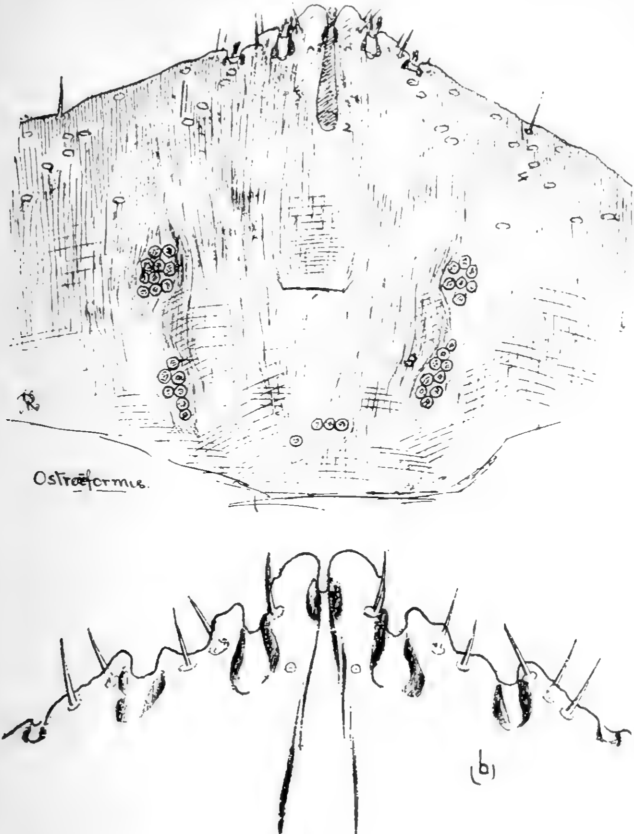

FIG. 18. Anal plate of Ostreæform or Curtis Scale, showing lobes, incisions, thickenings, and spines. The inner angles of second lobe are decidedly developed; outer lateral margin of second lobe undulating; chitinous processes of first incision long and nearly equal in size; (b) anal plate much enlarged.

The Cherry Scale, *Aspidiotus Forbesi* (Johnson). Figs. 19 and 20.

The Cherry Scale, although found in several localities in Ontario, has not yet, with one or two exceptions, been reported as doing much damage.

The adult female scale is circular, nearly smooth, slightly convex, about 1.3-1.5 mm. in diameter, and has the exuviæ usually centrally situated. The general color varies from a yellowish brown to a greyish yellow. The exuvial part is usually orange.

The adult female scale is very difficult to distinguish from the San José. The San José, however, has the exuviæ light brown, the Cherry has orange exuviæ. The immature San José scales are often dark and have a distinct nipple, with a ring or depression around it; the immature Cherry scales are much the same color as the mature scales and there is not the same prominent nipple and encircling ring. Furthermore the San José scale discolors the fruit, bark and cambium layer, the Cherry scale does not.

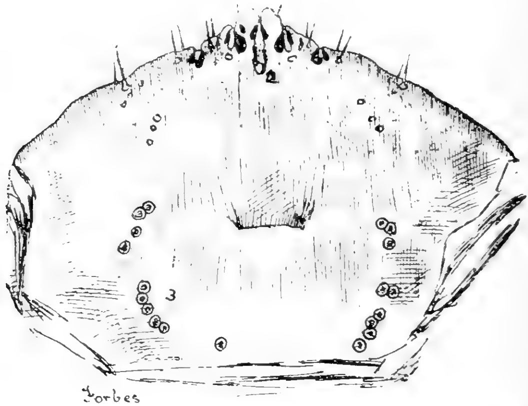

FIG. 10. Anal plate of Forbes Scale, showing lobes, incisions, thickenings, and spines; also anal opening (2), vaginal opening (1), and ventral glands (3). Notice that the median lobes approximate at apex, and that the inner thickening at first incision is very large and club-shaped.

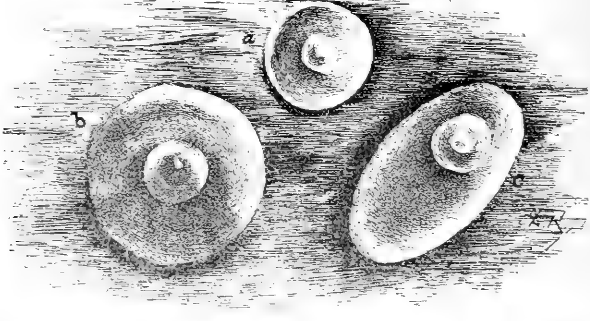

FIG. 20. Forbes or Cherry Scale. (*a*) Young scale, light colored, with central nipple but no circular groove; (*b*) adult female scale with central or nearly central, orange-colored nipple, and gray outer margin of scale; (*c*) male scale, showing the oval shape, and nipple near one end. The body of the insect is under the scale.

The life history of this scale is said to be as follows: It passes the winter in a partly grown stage. The males emerge about the end of April. In May the young begin to come forth and eggs and young may both be found up to about July. There are two broods in some of the American States, but whether there is more than one in Ontario has not yet been discovered.

The Cherry scale has been found in Ontario at Ottawa, London, St. Catharines, Grimsby, and in Prince Edward county.

The host plants so far discovered are cherry, apple, hawthorn, fragrant currant, and beech.

Remedies:

The same remedies should be used as for the San José scale.

Natural Enemies:

Several species of Chalcid flies are said to attack it, also a tiny white mite, and the twice-stabbed ladybird beetle (*Chilocorus bivulnerus*, Muls.)

The English Walnut Scale (*Aspidiotus juglans-regiæ*, Comst.) Figs. 21 and 22.

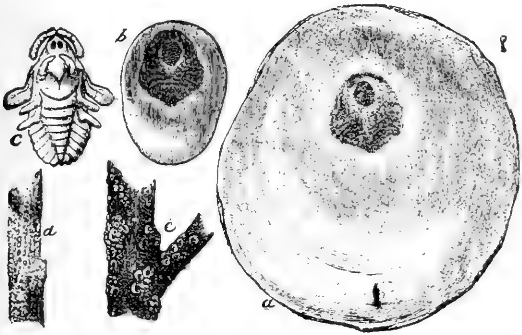

FIG. 21. The English Walnut Scale (*Aspiodiotus juglans-regiæ*). (*a*) Female scale; (*b*) male scale; (*c*) male chrysalis; (*d*) male scales on twig; (*e*) female scales on twig. *a*, *b*, *c*, enlarged; *d*, *e*, natural size. After Howard. From U.S. Dep. Agr., Year Book for 1894.

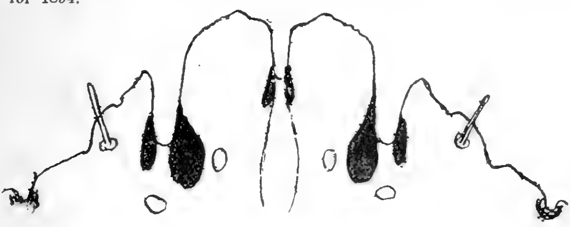

FIG. 22. Anal plate of English Walnut Scale, showing the large median lobes, and notched outer margin of second lobe.

The English Walnut scale has been found in Ontario in only two or three localities, although it probably exists in several others. If some sam-

ples from Collingwood, sent by this department to Washington, and thought by the authorities there to belong to this species, should prove to be really such, the scale is capable of doing great injury to the trees it attacks. The poplars and willows at Collingwood on which it was found were very thickly covered, and were dying, apparently from the effects of the scale.

The adult female scale is larger than any other species of Aspidiotus described in this paper, averaging almost 3 mm. in diameter. It is circular or nearly circular in outline, very flat for its size, resembles closely the color of the bark it is on, being usually a pale grayish brown. The exuviæ are usually eccentric and are orange or reddish in color, though often this color is partly concealed by a waxy secretion.

Though the adult female of this scale is easily distinguished from the San José by its large size and reddish eccentric exuviæ, yet the winter stage of some specimens we have received is with great difficulty distinguished from the winter stage of the San José. The chief points of distinction seem to be: (1) The winter stage of the Walnut scale is a little larger than that of the San José; (2) Even in these winter scales, the reddish exuviæ can often be seen with the aid of a lens although a waxy secretion almost conceals it. In the San José scale this reddish color does not appear.

We have very little knowledge of the life-history of this scale. From specimens we have seen this autumn it seems to pass the winter for the most part in an immature stage. It does not bring forth its young alive but lays eggs. There is probably more than one brood in a season.

The scale has been found only at Grimsby and Collingwood (?)

The host plants so far discovered in Ontario are apple, willow and poplar.

Remedies:

The same remedies should be used as for the San José scale.

We have not been able to observe what natural enemies this scale has.

The Putnam Scale, *Aspidiotus ancylus*, (Put.) Fig. 23.

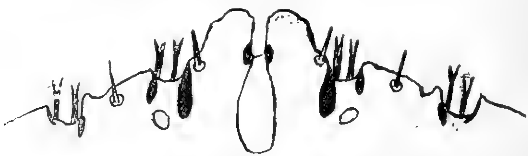

Fig. 23. Anal plate of the Putnam Scale, showing the unequal thickenings in first incision, the rudimentary second lobe, and the wide interval between median and second lobes.

The Putnam scale is distributed fairly widely throughout Ontario. It has not, however, been known to do much damage in the province although in some of the states across the boundary it is said to have been quite destructive.

The adult female scale is usually more nearly oblong than circular, about 1.5 mm. long, 1-1.3 mm. wide, and slightly convex. The general color is greyish black, varying somewhat with the color of the bark it is on. The exuvial part is eccentric and practically always red or reddish. Sometimes this red color is obscured by a whitish film which can easily be rubbed off.

This scale can be easily distinguished from the San José by its oblong shape and the red eccentric exuviæ. It has the peculiarity of producing in a small degree the purplish color so characteristic of the San José scale.

It passes the winter in a nearly full grown stage. The males begin to appear, it is said, in May. In late spring or early in summer the female lays from 30 to 40 eggs. These hatch in July. There is only one brood in a season.

The scale has been reported from Ottawa, Toronto, Belleville, St. Catharines, and Kingsville.

It has been found on plum, elm, and willow in Ontario, but is said to attack also cherry, apple, red currant, maple, oak, ash, and beech.

Remedies:

The same remedies should be used for this scale as for San José.

Parasites:

The only parasite we have heard of as attacking it is a minute Chalcid fly, *Coccophagus varicornis*, (How.)

Osborn's Scale (*Aspidiotus Osborni*).

Osborn's scale is found on forest trees in northern and western Ontario.

The mature female is about the same size as the Curtis scale, averaging about 2 mm. in diameter. It is very smooth and circular, and the exuviæ is eccentric. The general color is brown, varying somewhat with the color of the bark of the host; under the loose bark of the paper birch the color is gray.

It has been found on paper birch, yellow birch, cottonwood, and white oak.

It passes the winter in a nearly full grown stage.

Parasites:

The work of Chalcis flies have been found on several occasions.

The New York Plum Scale, *Eulecanium cerasifex* (Fitch.) Fig. 24.

The New York Plum Scale has become one of our most common scales and like the Oyster-shell scale has spread over practically the whole province. Though not so destructive as the Oyster-shell, it is often quite injurious where abundant and sometimes kills the infested tree.

The scale is one of our largest species. The mature female is nearly hemispherical, but usually a little longer than broad, being 3-5 mm. and 2.5-4 mm. wide. It varies in color from light brown to almost black. The surface is usually glossy with, however, numerous little depressions and elevations which sometimes take the form of grooves and ridges radiating from the apex to the base.

The male scale is very unlike the female in shape, size and color. It is elongated in form, 2-2.5 mm. long, and 1 mm. wide, only slightly convex, and is grayish white in color. Both male and female scales are found near each other on the same branch.

The winter is passed by both sexes in the half-grown stage. The winged males appear June 1st (this year, 1907, it was June 12th), and soon after this the females lay their eggs and die, but their dead body still remains as a cover for the egg mass. About the end of June (this year on July 19th), the eggs begin to hatch out. There are sometimes about 1,000 eggs laid by a single scale. The young scales move from the branches to the leaves where they remain until autumn and then migrate back to the branches for the winter. There is only one generation in a year.

We have found this scale on a great range of trees and other plants at Guelph, the following being the list as observed up to date of writing:—apple, plum, pear, mountain ash, hawthorn, currants, gooseberry, wild red

raspberry, wild black currant, wild grape, Virginia creeper, elder, red-osier dogwood, mountain maple, black maple, silver maple, white ash, black ash, beech, blue beech, ironwood, basswood, alder (Alnus incana), poplar (Populus alba), rock elm, American elm, prickly ash, butternut, black walnut, catalpa, hazel-nut, pin-cherry, bur oak, English oak (*Quercus robur*), sweet hickory, and many species of herbs near infested trees.

Remedies:

(1) The lime sulphur spray. This must be very carefully put on as the scales for the most part in fall, winter, and spring, are to be found on the lower side of the branches.

(2) Kerosene emulsion, applied when the tree is dormant, preferably as soon as the leaves fall in autumn. Dilute the stock emulsion with four parts of water.

(3) Kerosene emulsion, flour kerosene, or whale-oil soap at ordinary strength applied as soon as eggs have hatched, which must be determined by actual observation each year.

FIG. 24. Twig of plum infested with Lecanium or New York Plum Scale. (*a*) The old scale of the previous summer empty and lifeless; (*b*) the immature wintering scales, which will become full grown like (*a*) next June.

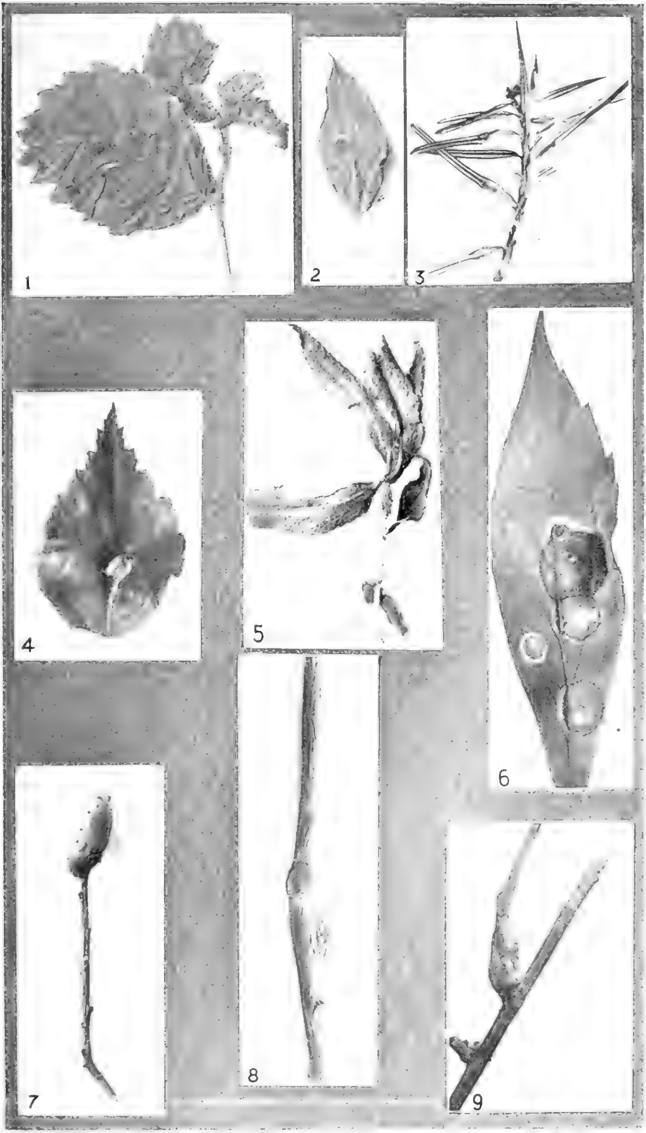

PLATE A.

1. Cecidomyia ulmi, Beuten.
2. Lasioptera corni, Felt.
3. Cecidomyia balsamifera, Lintner.
4. Hormomyia cratægifolia, Felt.
6. Choristoneura flavolunata, Felt.
7. Rhabdophaga batatas, O.S.
8. Agromyza æneiventris, Fallen.
9. Rhabdophaga nodulus, Walsh.

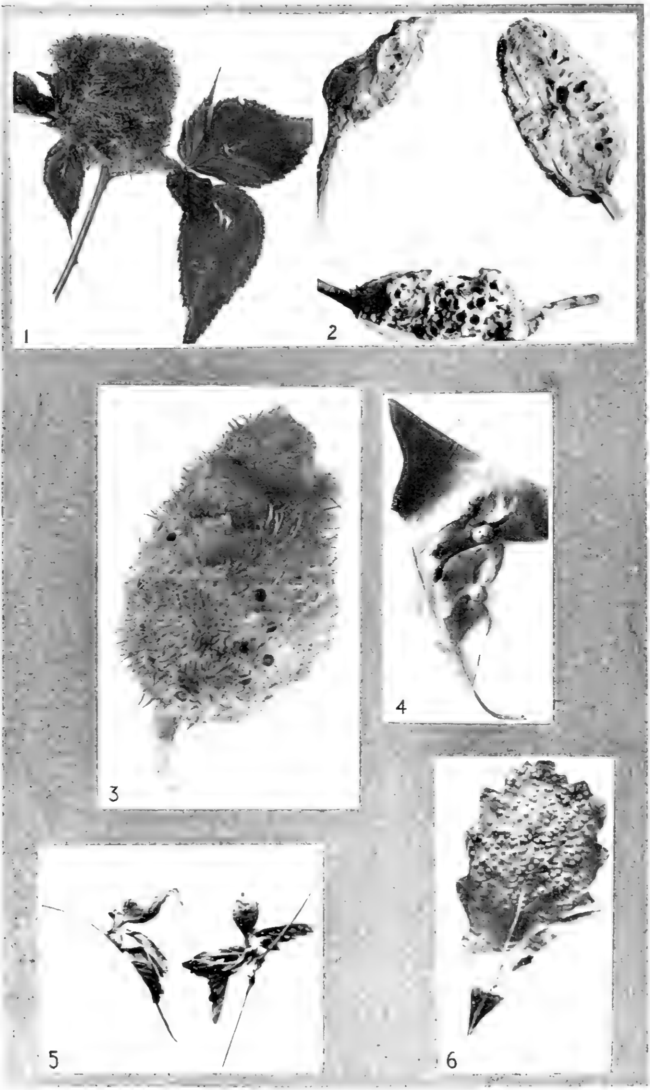

PLATE B.

1. Rhodites sp. on Blackberry.
2. Diastrophus turgidus, Bass.
3. Rhodites multispinosus, Gill.
4. Andricus futilis, O.S.
5. Diastrophus potentillæ, Bass.
6. Neuroterus umbilicatus, Bass.

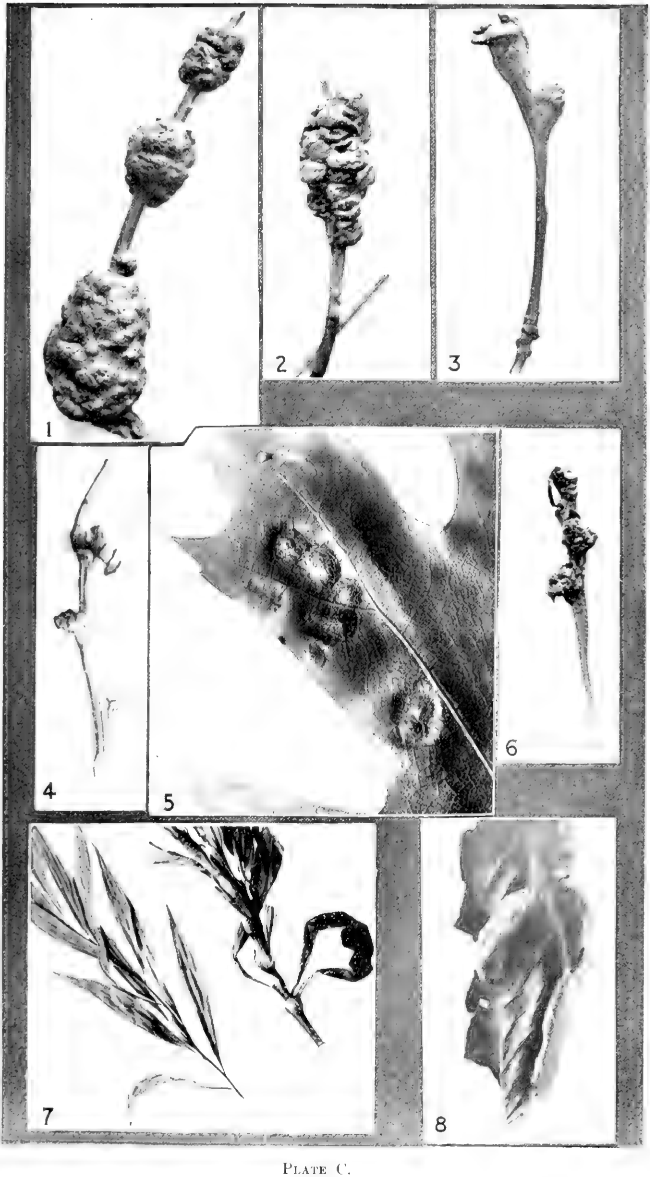

PLATE C.

1. Andricus punctatus, Bass.
2. Biorhiza forticornis, Walsh.
3. Andricus clavula, Bass.
4. Cynips strobilana, O.S.
5. Andricus papillatus, O.S.
6. Andricus topiarius, Ashm.
7. Eucosma scudderiana, Clem.
8. Pemphigus ulmi-fuscus

PLATE D.

1. Eriophyes sp., Amelanchier Canadensis.
2. Eriophyes sp., Juglans nigra.
3. Eriophyes sp., Populus italica.
4. Eriophyes sp., Vitis cordifolia.
5. Eriophyes sp., Salix fragilis.
6. Young Oyster-shell scales parasitized by a fungus.
7. Curtis scale parasitized by a fungus.

Parasites:

(1) A fungus disease (Cordyceps clavulata), attacks and destroys many of the scales.

(2) At least 3 chalcid flies, *Pachyneuron altiscuta* (How.) *Eunotus lividus (Ashm.)*, and *Coccophagus cognatus* (How.)

(3) Several species of lady-bird beetles.

(4) A large flesh-colored species of larva was found feeding on the eggs but we were not able to rear the adults.

The Terrapin Scale, *Eulecanium nigrofasciatum* (Perg.)

This scale was first discovered in Ontario in 1901 at St. Catharines. Up to the present time it has been reported to us only from St. Catharines, Walkerville, and Windsor. In each case the infested twigs forwarded were taken from maple trees and these were literally covered with the scale. It is clear from such specimens that a badly infested tree would soon die, and so the scale is one to be guarded against. Mr. Sanders of the Bureau of Entomology, Washington, in his circular No. 88, says that the scale must be considered a "dangerous pest."

The easiest time to recognize this scale is in the winter stage. At this season it is considerably smaller than the New York Plum scale, *Eulecanium cerasifex*, which, even when mature, it never equals in size. It has the same general shape as this well known scale, being nearly hemispherical. It is about 2 mm. in length and slightly less in width. Along the top running longitudinally is a reddish streak or stripe about 1 mm. long and .3 mm. wide. The rest of the surface is usually mottled red and black, the red forming the ground, so to speak, and black stripes radiating from the reddish top to the base. Sometimes the black forms a belt around the scale extending from the red boss or crown nearly to the base, which has also often a red margin in such cases. Not uncommonly a scale looks almost entirely red or on the contrary almost entirely black. When mature there is still the same general color and shape but there is an increase in size, the scale now being 3-3.5 mm. long and somewhat less than this broad. Later in the season the color fades.

A peculiarity, at least, of the winter stage of the scale is that when punctured or crushed, a reddish liquid exudes from the wounds.

The eggs are laid in the spring and hatch about the end of June. In August the tiny winged males emerge and consequently the half-grown females are fertilized the same season.

Although only maple trees have been reported to us as being attacked up to the present time in Ontario, yet we find that in the United States the scale infests not only these but also the peach, plum, apple, pear, quince, hawthorn, and several other trees. Hence it is clear that fruit-growers should be on their guard against it.

Remedies:

The lime-sulphur wash has proved a failure in the case of this scale and the most satisfactory remedy so far discovered is to spray the trees carefully when the leaves are off with kerosene emulsion of about 25 per cent. strength. Care should be taken to prevent the emulsion running down the trunk and getting to the roots which it would probably injure. Late autumn or early spring before the buds begin to burst would be the proper time to spray. While this is practically the only spray recommended against this scale insect, some very able entomologists doubt whether even it is anything like so successful as its advocates claim. Seeing that there is so much doubt about the effectiveness of washes and that the scale is capable of doing grea

damage, the proper course to take is to be on one's guard against allowing it to get a footing and, if a tree should be found to be infested, cut it down and burn it at once, thus taking no risks.

Parasites:

This scale like almost all the rest has its insect foes, a tiny chalcid fly of the genus Coccophagus has been found to attack it. A fungus parasite known as Cordyceps clavulata is not uncommon on this scale.

Eulecanium caryæ, (Fitch).

Eulecanium caryæ is said to be the largest known species of Eulecanium. It has been in Ontario for at least ten years, having been discovered by Dr. Fletcher in the Niagara district in 1898. Judging from the fact that it has been found in that district and that we have discovered it at Guelph on several trees in the forest, it probably occurs at least all over the south-western part of Ontario. From our own experience and that of others we believe that the scale is very seldom abundant on any tree; in every case where we discovered mature scales there were only two or three at most, and often only one specimen to be found on a branch (always on the under side). Consequently the scale is seldom sufficiently injurious to cause any alarm.

It is easily identified by its large size, being more than twice as large as the New York Plum scale (Eulecanium cerasifex). Like this scale Eulecanium caryæ is more or less hemispherical in shape. It is 7-10 mm. long, 6-9 mm. broad, and 3-4 mm. high. The surface is glossy, light brown to black in color, and covered with a fine powder. On all the specimens a keel-like structure ran longitudinally from end to end through the centre. The rest of the surface was more or less rugose. In some cases we could see fine (including the keel-like structure), nearly parallel longitudinal ridges; in others these ridges, except the keel, were not perceptible.

We have not yet traced out the life history of the scale, but from observations made believe that it is probably very similar to that of the New York Plum scale; that is, it passes the winter in the nearly mature stage, the males emerge in late spring; the eggs, which are very numerous and white in color, hatch out in July; the young migrate to the leaves and re-migrate to the branches in the autumn.

This scale has been found at Guelph on the hawthorn and American elm, and at St. Catharines on the peach.

Remedies:

Seldom any need be applied, but the same remedies as are used for the New York Plum scale should destroy this one.

Parasites:

There is a very little doubt that the failure of this scale, laying as it does a very large number of eggs, to increase rapidly is to a great extent due to the attacks of parasites. Dr. L. O. Howard informs us that a chalcid, Chiloneurus albicornis, (How.) attacks it. (Bull. vii, N. S. Div. Ent. U. S. Dept. Agr. 1897, p. 63). This is one of probably a considerable number of parasites.

Kermes pubescens (Bogue).

Kermes pubescens is a large scale resembling the New York plum scale and other Eulecanium scales, but differing in external appearances chiefly in being more nearly spherical. It has been found by us at Guelph, Toronto, and Perth, hence is probably wide spread over the province. Only oak trees are attacked, as it was found in abundance on each infested tree it must do considerable injury. Mr. Bogue, who discovered and named the scale, reports it as attacking the young twigs and leaves, but we have always

found it in the cracks of the bark on the trunk and branches and have not yet observed it on very young twigs or on leaves.

The mature female scale is nearly spherical as a rule in shape, though often it seems to be modified in form by its position in the cracks or fissures of the bark. It is 3-4 mm. long, 3 mm. high, varies in color from light to dark brown, often mottled with black, is shiny in appearance and covered with a short white pubescence.

The male scale resembles very much the male of the New York Plum scale. It is, however, whiter, being snow-white. In shape it is oblong, 2 mm. in length, 1 mm. in width and fairly convex.

The winter is passed by both sexes in the nearly mature stage. The males emerge about the first of June or a little earlier. This year '07 the season was late and they were observed coming forth June 12th. Though the females are fertilized shortly after this we have not yet had opportunity to discover the date when the eggs hatch.

Remedies:

(1) Kerosene emulsion 25 per cent. put on when the trees are dormant should kill the scale. The tree must be soaked, however, to ensure the spray getting into the crevices of the bark where the scales are.

Parasites:

A considerable number of the scales observed had been perforated, evidently the work of a small chalcid fly.

The Cottony Maple Scale, *Pulvinaria vitis* (L.).

The Cottony Maple Scale is by no means a stranger in Ontario. It is found all over the western part of the province at least, and probably over much of the remaining parts also. As the name indicates, it attacks the maple chiefly, and in cities often does much damage to maple shade trees. It is, however, rarely abundant for many seasons in succession, because of the attacks of parasites.

The scale is most easily identified in spring or early summer. At this time of the year it appears as a brown, elliptical, convex insect, with so large a cottony-like egg-mass protruding from behind and beneath that the scale seems to be standing on its head, or nearly so. The egg mass and scale together are about 1 cm. long, the scale itself being about 1-3 of this length. The cottony egg-mass has given the scale its name and makes its identification easy.

The young lice hatch about the middle of June usually, the hatching period extending over a couple of weeks. The tiny insects at once migrate to the underside of the leaf, though some also establish themselves on the upper surface. On the leaves they usually arrange themselves alongside the midrib and veins. About the end of August the winged males emerge and fertilize the females. A few weeks later the females desert the leaves and go back to the branches, where they pass the winter. In the spring of the year they rapidly swell, and in early summer form the cottony mass and lay their eggs in it. Hence there is but one generation in a year.

Although the maple trees are the ones most commonly attacked, the scale is found on many other trees as well. It has been found at Guelph on the following maples: Acer saccharum, A. saccharinum, A. nigrum, A. rubrum, and A. negundo; also on basswood, American elm, hawthorn, white poplar (Populus alba), scrub willow, red-osier, dogwood, ilex (verticillata), Spiræa (salicifolia) and grape vines.

Remedies.

Except in towns there is very little need of using any remedy because parasites keep the scale well in check and, as mentioned above, it is seldom bad many years in succession. In towns, await the hatching of the young, and shortly afterwards prune severely, and where valuable trees are attacked spray these thoroughly with kerosene emulsion, flour kerosene or whale-oil soap. More than one spraying will probably be necessary.

The Oyster-shell Scale, *Lepidosaphes ulmi,* (Linn.) Fig. 25.

The Oyster-shell scale is found in almost every district in Ontario, and is doing more injury to the fruit trees of the province as a whole than any other scale.

The scale can easily be recognized even without the aid of a lens. It is 2.5-4 mm. long, and .75-1 mm. wide in the broadest part, tapers toward the the end, is shaped like a diminutive oyster-shell, and closely resembles in color the bark on which it is found. The small end, or exuvia, is usually much lighter in color than the rest. The male scale differs from the female chiefly in being considerably smaller and broader in proportion to its length.

It passes the winter in the egg stage, from 20-100 eggs being concealed under the covering of a single scale. The eggs hatch about the first week in June. The tiny, white, young scale insects run about for a day or two on the bark or leaves and then insert their sucking tubes in some chosen spot from which they never move during the rest of their life. There is only one brood in a season, but even so, the scales increase very rapidly where no attempt is made to keep them in check. Badly infested trees become much weakened and often die.

Not only does this scale attack apple, pear, plum, and cherry trees, but it also attacks currants, gooseberries, rose bushes, spiræas, lilacs, and numerous shade and forest trees, such as the mountain-ash, hawthorn, red-osier dogwood, black and white ash, American aspen, prickly ash, mulberry, and horse-chestnut.

Remedies.

There are several remedies that can be used with success in combating it:—

(1) Spray with kerosene emulsion, flour kerosene, or whale-oil soap during June as soon as all the eggs seem to have hatched. This date can easily be ascertained by examining carefully, even with the naked eye, a few infested branches. These remedies are the most popular.

(2) The lime-sulphur wash. This remedy, though not so popular as No. 1, has given excellent results when well made and carefully put on late in the spring when the buds are well swollen or are opening.

(3) Whitewash. The trees must be sprayed twice, with an interval of a few days between, with whitewash. This should be done as soon as the leaves fall in the autumn. Use 1 to 2 lbs. lime to 1 gal. water.

Parasites.—The most common parasites are: (1) A tiny little mite, probably *Tyroglyphus malus,* that preys both upon the adult and the eggs; (2) a small, yellowish chalcid fly, probably *Aphelinus mytilaspidis,* Le Baron, the larva of which preys upon the eggs (scales perforated by small, round holes have been parasitised by this kind of insect); (3) certain species of ladybird beetles, especially the twice-stabbed lady beetle (*Chilocorus bivulnerus*) Muls. This year we found a pink fungus attacking the young scales, and on a mountain ash tree, in Toronto, which was covered with scales, the pink fungus parasitised and killed nearly all the scales on the tree. (See Plate D. Fig. 6.).

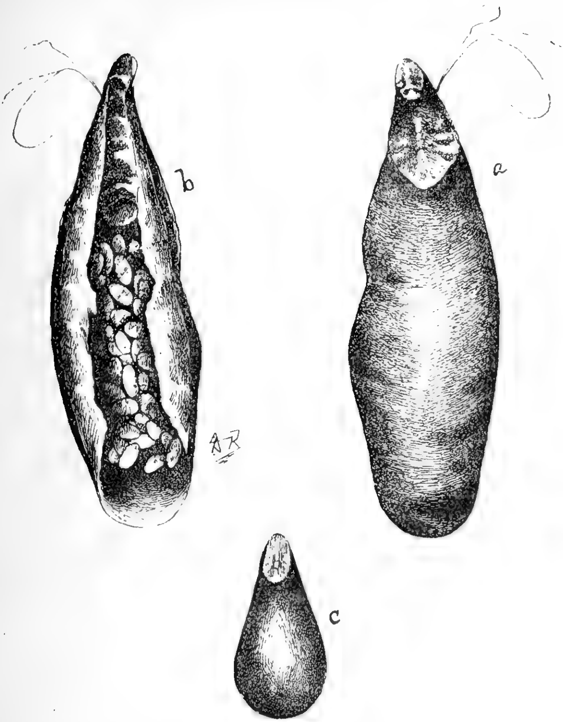

FIG. 25. Oyster-shell Barklouse (*Lepidosaphes ulmi*). (a) Adult female, back view, showing the two moulted skins at anterior end, and the bristles of the sucking tube; (*b*) adult female turned over, showing the insect at the anterior end and the eggs at the posterior end; (*c*) adult male scale, much smaller than female, with one moulted skin at anterior end.

The Scurfy Scale, *Chionaspis furfura*, (Fitch). Figs. 26 and 27.

The Scurfy Scale, though widely distributed throughout Ontario, is seldom found in so great abundance as the Oyster-shell. Badly infested trees or other plants are very much weakened and not infrequently die as a result.

The mature female scale is somewhat of the shape of the Oyster-shell, but is much broader in proportion to its length, and is more properly described as pear-shaped, being 2-3 mm. long, 1-2 mm. wide in the broadest part and tapering rapidly to a fine point at one end. It is very slightly convex and is grayish white in color. The scurfy appearance which it gives to a badly infested branch or twig has evidently been the cause of its receiving its present popular name.

The male scale is very different from the female. It is elongate in shape, is only about 1-3 the length of the female, is whiter in color and has three parallel longitudinal ridges on its back (tricarinate).

The Scurfy Scale has a very similar life history to the Oyster-shell. It passes the winter in the egg stage, there being from 20-80 purplish red eggs under a single scale covering. About the first of June these hatch into tiny orange or reddish brown larvæ, which run about freely for a few hours, and then in some favourable place insert their sucking tube, or proboscis, into the bark, leaf, or fruit and remain stationary henceforth. There is only one generation in a year.

Many kinds of trees and shrubs are attacked by the scale, but the most common are the apple, pear, quince, currant, gooseberry, mountain ash, white ash, hawthorn and horse chestnut.

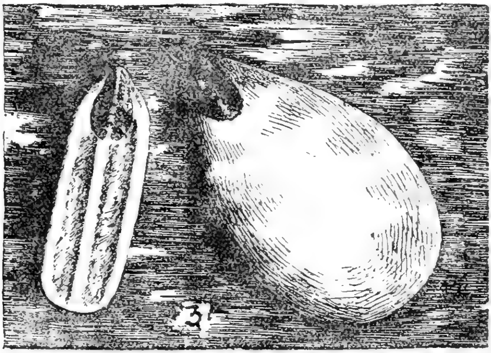

FIG. 26. Scurfy Bark-louse (*Chionaspis furfura*). Adult male and female.

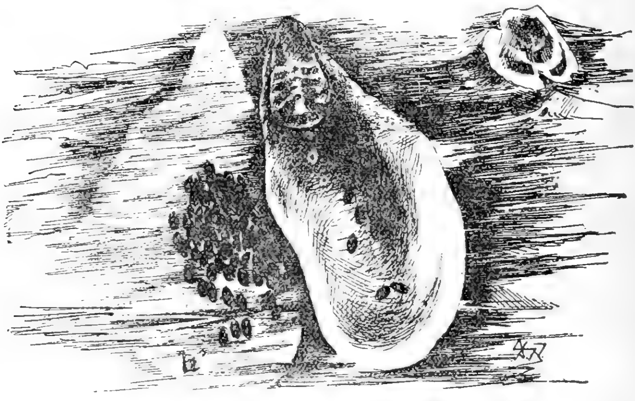

FIG. 27. Scurfy Bark-louse (*Chionaspis furfura*). Adult female, under surface, showing the insect at anterior end, and the numerous purplish eggs.

Remedies.—The same remedies should be used as for the Oyster-shell scale.

Parasites.—The parasites are largely the same as those that attack the Oyster-shell. The most common are (1) the mite, *Tyroglyphus malus* (Schimer); (2) a small chalcid, *Ablerus clisiocampæ*, Ashm; (3) the twice-stabbed lady beetle, *Chilocorus bivulnerus*, Muls.

The Rose Scale, *Aulacaspis rosæ*, (Bouche).

Here and there all over the province we find the Rose Scale attacking rose bushes, and blackberry and raspberry canes. The plants attacked are nearly always in damp, shady places, such as overcrowded gardens, and it is seldom that we find the scale out in open, airy plots.

The mature female scale is nearly circular in shape, moderately convex, 2-2.5 mm. in diameter, almost snow-white, except for a brownish yellow spot, the exuviæ, situated towards one side and extending nearly to the centre.

The male scale is also white, but is very different in shape and size. It is elongate, about 1 mm. in length, 3 mm. in width, and has three parallel ridges running longitudinally along the upper surface.

The scale may pass the winter in almost any stage, from the egg to the mature insect. Breeding goes on almost continuously from the warm days of spring to the severe frosts of late autumn.

Remedies.—From the tendency of this scale to occur almost solely on damp, much shaded plants, the most rational method of treating it is to prune out the bushes so as to let plenty of air and sunlight get access to them. In this pruning, of course care should be taken to cut out the worst infested parts. In special cases, it may be necessary to resort to lime-sulphur, kerosene emulsion, or whale-oil soap, to be applied when the plants are dormant. Invigorating the plant by fertilizers is also helpful.

The Pine-leaf Scale, *Chionaspis pinifoliæ*, (Fitch).

The Pine-leaf scale is very common in many parts of Ontario, and is probably found all over the province. It has not, however, so far as we know, caused any perceptible injury to the trees, although reports from New York state go to show that wherever it is very abundant on a tree it does much damage.

The scale is easily identified from its shape, size, color, and the fact that it is only found on coniferous trees. The female scale resembles to a large degree the Oyster-shell scale in size and shape, but unlike it is seldom curved and is almost entirely snow-white, except for the exuviæ, which are dull colored. The scales are not always of the same shape, some being longer and narrower in proportion to their length than others. This, in many cases, seems to be due to the shape and size of the needles they are situated on. The average length is 2.5-3.5 mm. and the average width .75-1.3 mm. The scale is more convex than the Scurfy Scale and is a little thicker in texture, though not nearly so thick and firm as the Oyster-shell scale.

The male scale very closely resembles the male Scurfy scale, and like it is less than one-third the size of the female scale. It is elongate, about 1 mm. long, 3 mm. wide, snow-white in color and has three parallel ribs or ridges running longitudinally along the upper surface.

The winter is passed in the egg stage. From 20-70 purplish eggs are to be found beneath a single scale cover. The eggs usually begin to hatch about the end of May, but this season were about three weeks later. There are said to be two broods each year, the females of the last brood laying their eggs late in the autumn.

The scale, as mentioned above, confines its attack solely to conifers. We have found it at Guelph on the following pines: White, Bull, Austrian,

Scotch, Jack, and Dwarf Mugho, and also on the Norway and White Spruce.

Remedies.—As a rule, there is no need of resorting to any remedy to control this scale as it is seldom sufficiently abundant to do much damage. If, however, it should be found in such numbers as to injure perceptibly trees in a lawn, kerosene emulsion can be used, but this would be impracticable, of course, in any place where there were a very large number of trees to treat.

Parasites.—About one-third of the scales examined this year were found to have been parasitised, apparently by a Chalcid fly. A species of mite was also found preying upon them. Thus it is probable that we owe much of our security against the rapid increase of this insect to these parasites.

THE LIME-SULPHUR WASH.

By L. Caesar, Ontario Agricultural College, Guelph.

From time to time during the last two years questions have arisen in connection with the lime-sulphur wash which have made the Entomological department feel that there was need of a further study of this important mixture in order that they might be able to give fuller and more definite information to fruit-growers. Accordingly Dr. Bethune and Mr. Jarvis, not having an opportunity themselves to devote their attention to this subject on account of the mass of other work to which they have to give their time and energy, asked me to begin the investigation this year.

After reading the best literature I could find on the subject and getting valuable suggestions in this way, I began to make the mixture on a small scale in the chemical laboratory, where I could use glass vessels and see the different phases passed through, so far as there was any physical evidence of these. It was my intention at first to attempt to study the chemistry of the wash, but I soon found that this would make a whole season's work and that in any case the field experiments were necessary first to show what chemical problems there were. This autumn Professor Harcourt of the Chemical department informed me that his department intended, if possible, this winter to study the chemical side of the wash. He asked me to let him have a list of any chemical problems that had occurred to me in connection with my work on it during the season.

After some laboratory experiments I began my field experiments. Any experiments, however, made at Guelph alone would be inadequate, because we have no San José scale here, and because we are also free from a number of plant diseases that are very troublesome in the more truly fruit-growing districts of the province. Hence, I determined to make a trip to the Niagara district in the spring when the wash was being applied to the trees, and again in the fall to see the results, and to interview the best fruit-growers to find out their experience with the wash. I tried, moreover, whereever possible, to supplement my own experiments by visiting particular orchards in other districts or communicating with men who were using the spray. In these ways considerable information about the wash has been obtained, although I am aware that it will require further experiments for two or three years longer before we shall know all that we should about this mixture.

I shall not attempt to give any account of the details of the experiments made, but rather will discuss the different points of interest in succession. Before proceeding to deal with these points, I should say that it was not

merely a few trees that were sprayed with the mixture at Guelph; almost 600 gallons of the spray were put on. Each tree was carefully done but was only sprayed once.

What Formula Shall We Use?

One of the first points of interest is to determine what formula is most satisfactory. While this is an important matter, yet there is room for a considerable amount of freedom. In countries like California and some other American States where there is very little rain, a weaker mixture than will suit our conditions may be used with good results. I found that the chief objection to using a formula as weak as 15 lbs. lime, 12 lbs. sulphur and 40 gallons water was that the spray was washed off the twigs too quickly by the spring rains. It is very important, however, that the spray should remain on all parts of the tree as long as possible. The lowest formula that seemed to me satisfactory, from my own experiments and those I observed elsewhere, was 20 lbs. lime, 15 lbs. sulphur and 40 gals. water. This formula has given excellent results. For instance, Mr. W. H. Bunting, of St. Catharines, one of the most successful fruit-growers, has used it for some years, and though the San José scale has been in his orchards for a long time and is very bad in neighboring orchards, he keeps it under complete control with lime-sulphur of the above strength. Many farmers, however, prefer to use a slightly stronger wash. The majority of those I met in the St. Catharines district used 22 lbs. lime, 18 lbs. sulphur and 40 gals. water. This is also about the average strength used at Grimsby, Winona and Fruitland. There is no trouble whatever in spraying a mixture as strong as this or even stronger, as I myself proved. New nozzles of the type of the "Friend" allow such mixtures to be put on in a fine mist without any trouble from clogging. There can be no objection then to a fruit-grower using a mixture of this strength or even stronger except that where spraying is done every year 20 lbs. lime, 15 lbs. sulphur and 40 gals. water give practically as good results and the expense is considerably less.

First Steps in Boiling.

Having decided then that 20 lbs. lime, 15 lbs. sulphur and 40 gals. water shall be the minimum strength, let us next consider the best way to go about making the wash. After testing several ways, I found none more satisfactory than the following: put about 13 gals. (about one-third of the total 40 gals.) of boiling water into the barrel. Turn off the steam and at once put the 20 lbs. of lime into the water. (Care must be taken to use only fresh unslaked lime). When the lime has begun to slake vigorously add the sulphur, which should have been made into a thick paste with boiling water before the lime was added. The whole should now be stirred as well as the boiling will permit. When the boiling begins to slacken, turn the steam on again. Stirring should be repeated every five minutes or so in order that any little lumps of sulphur may be more readily broken up and go into combination. Boiling must always be vigorous, so vigorous as to keep the contents of the barrel in constant commotion and cause the liquid to splash up to the top.

How Long to Boil.

One set of experimenters used to say that boiling should be continued until the deep green color came, others said to boil until the orange or amber shade was reached. When Prof. Harcourt and I visited the St. Catha-

rines district last spring and saw the dirty, dark green color characteristic of most of the spray that was being used, we both remarked that we could not possibly get such a color with our Guelph lime. On our return I procured, with Prof. Harcourt's assistance, a bushel of lime from Port Colborne and another from Beachville. Laboratory tests were made with each of these, and with Guelph and Caledon limes, to see what color of wash would be obtained from each kind. The results were interesting. Port Colborne lime gave a dirty dark green, Beachville a greenish orange or greenish yellow, Guelph was slightly lighter in shade, Caledon gave a green but one considerably lighter than that from Port Colborne lime. Each kind of lime was boiled for one hour under as nearly as possible exactly similar conditions. The formula used was 22 lbs. lime, 18 lbs. sulphur and 40 gals. water. Hence it is quite clear that the color obtained depends solely upon the kind of lime used. For general directions, therefore, it is not possible to say what color must be reached. The best way is to boil *vigorously* for one hour. By the end of this time all the sulphur will have entered into combination with the lime and further boiling will not make the wash more effective. It should be remembered that if the barrel is nearly full or even half full of water, it will not boil quite so rapidly as if there were only about 13 or 14 gals. of water in it.

Is it Necessary to Use any Special Kind of Lime?

Whether the lime of one's own district will give satisfactory results or not is an important question. There is very little doubt that the lime with a high percentage of calcium in it is more desirable than a lime like that of Guelph, containing nearly 40 per cent. of magnesium.

This element will not unite chemically, to any extent at least, with sulphur, and hence to some degree weakens the wash. However, I have found that even Guelph lime will give good results though not quite so good as Port Colborne or Beachville lime. Of these latter two, Port Colborne was the more convenient to use, because the wash made from it stands up better than any other I have experimented with, and so requires less agitation in the field. If any one is in doubt about the spraying value of his lime, he could easily have it tested by forwarding a sample to the Chemical department, but there is little question that good results will be obtained from almost any kind of lime. It is always easy to send for a bushel of some known lime like Port Colborne and compare results with those from the home lime.

The Dilution of the Mixture.

Many farmers dilute with cold water, but it is more desirable that hot or warm water be used so that the spray will be put on fairly hot. There are several reasons for this: (1) It is easier to spray with a warm than a cold mixture because the nozzle is less likely to clog. (2) The spray penetrates crevices and covers the bark better if put on hot. (3) If the mixture is allowed to cool there is a danger of certain substances crystallizing out in the form of tiny orange needles. This fact suggests that, if for any reason the mixture is left over night, it will be necessary to reboil it for a short time to bring these crystals into solution again. A convenient method that I have used is to dilute with cold water and then turn on the steam for a few minutes to heat the barrel up a few degrees before transferring the mixture to the spray tank.

DEVICES FOR BOILING.

Much the handiest and cheapest method of boiling is that a number of farmers should club together and hire a man to boil for them with a steam-engine. An ordinary threshing engine is generally used. An engine of this sort can be so adjusted as to boil from eight to ten barrels at once. A number of farmers have small upright steam generators, each of which costs about $125. This is a very satisfactory method of boiling. Many farmers, however, are doing excellent work with ord'nary large iron kettles, each holding about 20 to 25 gallons. These are either placed in a brick arch or are enclosed by sheet iron so as to concentrate the heat and prevent the wind from blowing the flames in every direction. One enterprising young Englishman had no engine or kettle, so he made a tight-fitting box of planks about 6 x 4 x 1½ ft. in size and covered the bottom and sides of this with sheet-iron to prevent the wood from catching fire. A small foundation about a foot high was built for the box to rest upon. An opening was left in the front of this to throw fuel in and a stove pipe arranged at the other end to draw off the smoke and create a draft. Upon the box a cover was placed of boards nailed together but with an opening along the centre to work a hoe in to stir the liquid. This simple device worked splendidly and good mixtures were made by it.

It is perhaps unnecessary to say that very few of the fruit-growers are to-day using the self-boiled method of preparing the wash. It has not given nearly so good satisfaction as the other method.

THINGS TO OBSERVE IN SPRAYING.

One often hears a great deal about the unpleasantness that accompanies the use of lime-sulphur. Much of this objection can be removed by attending to the following points: (1) Every precaution should be taken to choose as convenient a place as possible for making and loading the spray. This place should not be allowed to become muddy. The use of a few boards and the digging of a little drain if necessary can usually remedy this defect. (2) Spraying should be done only with and never against the wind. (3) Long hose should be used so that the driver and horse need not be brought close to the tree, and so may escape getting covered with the spray. (4) Workmen should be provided with suitable gloves to protect their hands. (5) A nozzle that will not easily clog, such as the "Friend" or "Simplex" should be used. Of course the spray should be carefully strained before it enters the tank.

To give satisfactory results good, careful spraying must be done. A day or two after an orchard has been sprayed, the spray-wagon should be taken over it again and any twigs or branches that have been missed can then be clearly seen and sprayed. Unless every part of the tree is drenched, the best results cannot be obtained. Some fruit-growers take so much care to see that every tree is thoroughly done that they even go through the orchard a third time to touch up any poorly sprayed places.

THE BEST TIME TO SPRAY.

I have not yet had a chance to test the merits of fall spraying. It is well known that it does not meet with so much favor as spring spraying. There is no doubt, however, that if a man knows that for some special reason he is likely to be unable to spray in the spring, he should by all means do so in the autumn as soon as the leaves fall. Of the spraying that is done

in the spring my experience leads me to give a decided preference to that which has been put on when the buds were actually bursting, compared with what was sprayed a month earlier. I find that the longer the wash remains on the trees the better the results. Now a spray put on a month before the leaves come out will wash off much more rapidly than that put on when the buds are opening, for the simple reason that, in the latter case, the leaves coming out soon after, break the violence of the rain and to a very considerable extent protect the spray. Many other experimenters have found the same result. In Bulletin No. 107 of the year 1906, Prof. Forbes, of Illinois, says, that January applications were only about half as efficient as those made in March. Allowing for difference of climate this would be practically the same thing here as spraying in March compared with the end of April. I found that trees sprayed for Oyster-shell scale on March 9th seemed to be but little benefited, whereas a very large per cent. of the scale was killed on those sprayed on May 10th, that is two months later. In every case where I examined trees for either Oyster-shell or San José scale I found that those on which the wash had remained longest showed much the best results; and, other things being equal, these were always the last sprayed trees.

But some one may ask, "How late is it safe to spray?" Personally I think it is perfectly safe to spray until the buds are nearly open. I sprayed a few currant bushes when the leaves were nearly an inch wide, and there were scarcely any signs of injury to the foliage. Apple and plum branches were also sprayed when the buds were almost open; a very slight sign of their having been burned in some cases around the edge was all the injury I could detect. I have seen a number of plum trees sprayed when the buds had practically burst and yet no injury resulted. In the Niagara district I made a number of inquiries on this point and in every case got the answer that it was quite safe to spray even while the buds were actually bursting. Peach trees, having a very tender foliage, should not be sprayed quite so late as more hardy trees. I found that a number of the farmers next year think of spraying, as an experiment, a few trees just after the blossoms have fallen. Their object is to see the effect upon aphids, plum rot, and apple and pear scab. Mr. J. W. Smith told me of an interesting experiment that had been performed by his tenant, Mr. R. Doughbrough, on Mr. Smith's farm at Vineland. I called on Mr. Doughbrough and asked him for further information. He said he had sprayed some pear and plum trees this spring just after the blossoms had fallen. He used the full strength 22 lbs. lime, 16 lbs. sulphur and 40 gals. water, boiled for 45 to 60 minutes.

The foliage, he claimed, was practically uninjured and was equally as good as that on trees sprayed earlier in the spring. The results upon the scab will be referred to later. Though Mr. Doughbrough was able to spray so late this year without injury, it is very probable that a difference of weather would have caused the spray to burn the foliage severely. Therefore, while it is advisable to spray as late as is safe, all spraying should cease before the blossoms come out. In any case the blossoms and leaves would prevent the spray from covering the bark of the tree thoroughly and so scale or other hibernating insects could not be so effectively controlled.

The Effect of Rain.

The question has sometimes been asked whether, if rain comes after spraying, it will be necessary to spray again. The best answer to this ques-

tion is that those who have any doubts about the rain having injured the spray should examine the trees a day or two later and see whether it has been washed off. If it has, the bare twigs or branches should be given another coat of the mixture. I sprayed a few trees purposely during a moderately heavy shower to see the effect. A day or two afterwards I examined them and found, as I expected, that there was very little of the spray on them. Some other trees, however, had been sprayed an hour before the shower began and had had time to become dry; these were not visibly affected by the rain and sleet. It stands to reason, moreover, that one should not spray immediately after a shower but should wait until the trees are dry. Before leaving this subject it is perhaps well to remove the misconception that at least some mixtures of lime-sulphur, once they have become thoroughly dry, are scarcely at all affected by rain. On one occasion this spring I investigated this point during a fairly heavy rain. Some of the trees had been sprayed with Port Colborne lime, others with Beachville, others with Guelph. In some cases the wash had been boiled 45 minutes, in others 60, in others 90, and in others as long as 3 hours. In every one of these cases lime was quite visible in the large drops on the underside of the twigs and branches. So that the length of time the wash remains on (one season compared with another) depends to a large extent upon the amount of rain that has fallen. In a very wet spring it is quite probable, therefore, that the efficiency of the lime-sulphur, while not entirely destroyed, would be greatly lessened.

How the Spray Kills.

It is very difficult to say just how the spray kills. Chemists have found that as a result of the chemical reactions that are constantly taking place on the tree, minute particles of sulphur are being constantly set free. Sulphur is known to be not only a good fungicide, but also an insecticide and it is possible that many of the insects like the San José scale, which have a thick covering to protect them, are killed by inhaling the sulphur which would naturally permeate everywhere, even beneath the scale. At any rate sprayed branches examined by me this year showed that by June 8th the San José scale insects were nearly all dead beneath their covering. In many cases the direct caustic nature of the wash seems to be the cause of death, e.g., of freshly hatched aphids. In others, such as the Oyster-shell scale, the wash seems to harden around the scale and prevent the young from hatching or from emerging after hatching. Under the same scale coverings of this insect I have found some of the eggs unhatched and others hatched but the young larvæ lying dead as if unable to escape. Of course it is very probable that some sort of caustic action also helps in destroying this scale. I have noticed that the scales are nearly always more brittle and so more easily removed on the sprayed trees than on the unsprayed: so that the eggs may to some extent be exposed to the weather and thereby destroyed. The same thing may hold true of the San José scale insects. I have not found, however, that a very large percentage of deaths is due to the scales being loosened and falling from the trees. Not more than three per cent., I think, of the Oyster-shell scale were destroyed in this manner. Later on in the season, however, the old dead scales on the sprayed trees began to peel off and leave the bark fresh and clean. Probably one of the most effective ways in which the wash acts as an insecticide is in keeping the bark covered and either making it difficult for the young scale insects to find a suitable and attractive place to settle down and insert their sucking tubes, or else making it impossible for them to insert them at all.

The fungicidal value of the wash is probably due, first to the sulphur and certain sulphur compounds which are well known to have a fungicidal value, and secondly to the covering left on the tree acting as a means of preventing spores from finding so favorable a lodging place as they otherwise would. The spray that falls on the dead leaves on the ground beneath the tree must do much to destroy spores that are hibernating there. We cannot, however, say definitely just how the wash gets its full insecticidal and fungicidal value.

Kinds of Trees and Shrubs that May be Sprayed.

Many fruit-growers are using this wash now on every kind of fruit-tree and shrub, even on raspberry bushes. A few are using it on grape-vines but this is unusual. It has no known injurious effect upon any of these plants.

Results Upon Insects and Fungus Diseases.

In discussing the results of the spray, I shall take up its effect upon insects first and then upon fungus diseases and upon the general health of the tree.

The San José Scale.

It seems hardly necessary to discuss the effectiveness of the lime-sulphur wash against the San José scale. There is none of this scale at Guelph, hence I had to rely upon my own observations elsewhere and upon the testimony of reliable fruit-growers for my information, on this point. I shall mention a few cases simply by way of illustrating that the wash will most effectively control this terrible pest. In the St. Catharines district the fruit-growers who have carefully and systematically sprayed their trees with this wash are not at all afraid of the San José scale, whereas those who never spray or carelessly spray are rapidly losing their trees by its ravages. Such men as the latter class explain the success of their neighbors on the ground that Heaven is kind to some people while others never have any luck. But let us take the case of Mr. Bunting, president of the Fruit-growers' Association of the St. Catharines district. On one part of his farm there were four or five rows of pear trees that had been sprayed with Scalecide at the strength of one part to fifteen of water. Nearby in the same orchard were several acres of peach trees that had been sprayed with lime-sulphur. As I walked along between the rows of pear trees and looked at the fruit on the ground, I saw that nearly every pear showed numerous red spots, which said more plainly than words that they were badly attacked by the San José scale. In the peach orchard, however, I sought in vain for some time to find a single scale. Mr. Bunting said there were some left but so very few that one often had to look a long time to find any. Another example of the effect of the wash was seen at Mr. Doughbrough's farm at Vineland. On this farm the lime-sulphur had scarcely been used at all until this year. The rapid increase of the scale, however, caused Mr. Doughbrough to try the wash this season on all infested trees. Last autumn several trees were so badly weakened by the scale that it was thought they would die. It was decided not to cut these down this spring but to keep them as a special test of the merits of the wash. Accordingly each tree was very carefully sprayed. The results surpassed the hopes of Mr. Doughbrough. On all the trees but one there was hardly a scale left and this one had fewer than the previous year. Furthermore the foliage was vigorous and the trees bore almost an average crop of fruit. It is unnecessary, however, to mention other ex-

amples that could easily be given from any farmer who has carefully used this wash against the scale. The fact is that wherever a man says he has not got good results against the San José scale from the use of lime-sulphur, it will turn out on close investigation to have been due to some fault in preparation or manner of application. The wash is at present the cheapest and most effective remedy for the San José scale in Ontario.

The Oyster-Shell Scale.

If we take Ontario as a whole we shall probably find that more injury is being done at present to fruit-growing by the Oyster-shell scale than by the San José, simply because the former is abundant in almost every orchard while the latter is limited to only a few districts. Consequently a good remedy against the Oyster-shell scale would be a great boon to the province. Whether one year's experiments are enough to decide this question is a matter of some doubt. I have endeavoured to make my experiments sufficiently extended to draw accurate conclusions. I have also visited several apple orchards in different parts of the province to compare results. It has been more difficult, however, to determine the effect of the wash definitely than one would have thought. The reason for this is, that owing to the cold, backward spring and the unfavorable weather which followed soon after the hatching of the eggs a very large proportion of the young scales, even on unsprayed trees, died before reaching maturity. When there were so many dead scales it naturally required much more careful work to determine accurately the effects of the wash. I found that on the trees that were sprayed before the middle of April almost all the eggs hatched out; on those sprayed about the middle of April much fewer, and on those sprayed in May when the buds were bursting, only a small percentage hatched. In other words wherever the wash remained well on the tree and covered it, there were very few eggs hatched compared with the cases where it washed off before the hatching season. Not all the eggs, however, on any tree were killed. I found practically the same results in other orchards. But some farmers, whose orchards I had not a chance to visit, reported that the wash had been useless. I think the majority of fruit-growers who have tried lime-sulphur only once or twice for the Oyster-shell scale have not been satisfied with the results. I believe the reason for this is largely that they sprayed too early in the spring and did not cover the trees so thoroughly as they should; in short they did not drench the trees from top to bottom. Had these points been attended to they would have killed a large percentage of the scale, though not all in one season. I have observed that where orchards are sprayed every spring for a number of years in succession there are practically no Oyster-shell scales left. But it is not enough to examine the trees soon after the eggs have hatched; they should also be examined later in the season to see what proportion of the young larvæ has matured. I find that on the trees that showed the most successful results in July, it is difficult to discover a single living scale this autumn. Yet one should not draw inferences rashly from this condition of affairs; for as I have mentioned above a very large percentage, apparently as high as 75 per cent. of the young scales died even on the unsprayed trees here this year. If then we are to judge by the earlier results we can only say that lime-sulphur is not a perfect remedy for Oyster-shell scale if it is only to be applied once; but that if it is put on late in spring and repeated for several years in succession it gives excellent results. For a single application I believe kerosene emulsion or flour-kerosene put on when the eggs have just

hatched gives better results. Whitewash applied twice in the autumn after the leaves have fallen is said to be an excellent and cheap remedy.

The New York Plum Scale.

All the scales of this species which were covered with the spray were killed and shrivelled up. As these insects hibernate chiefly on the underside of branches and twigs and are sometimes found in great abundance on this part of the lowest branches, great care should be taken to see that the spray is forced up through the tree from beneath as well as driven in from the side or allowed to fall upon the branches from above.

The Pear-tree Psylla.

I asked the opinion of those farmers who have tested the effect of this wash upon the Pear-tree Psylla. The most definite information I got on the subject was from Mr. E. M. Smith, of Winona. Mr. Smith was one of the first men in the district to begin using lime-sulphur. It occurred to him one year that the wash might destroy the Psylla, so he made a special test. A certain plot of pear trees were sprayed with lime-sulphur, and another plot equally bad with the Psylla was left unsprayed. The result was such as to convince him most strongly that the wash would destroy this insect.

Aphids.

Whether the lime-sulphur will destroy aphids' eggs and thus control the aphid pest is a much disputed question. Some of the fruit-growers think it will, others think not, but none whom I met could give definite information. In some of my own experiments this year the aphids had already hatched and were on the ends of the opening buds; some also had worked their way in among the tiny bud leaflets. About 50 per cent., as nearly as I could tell, were destroyed by the wash. Only those died that the spray had actually fallen upon. Those that were in among the leaflets of the bud were of course safe, and in spite of the most careful spraying some of the others failed to be hit. On trees that had been sprayed before the hatching of the eggs, I found it impossible to determine the effect on the eggs simply because there were scarcely any eggs to be found. In order to test this point better, a tree with numerous eggs on the twigs was sprayed this autumn on November 23rd, but it is not possible to determine the results in time for this paper. A number of good entomologists tell us that the wash does destroy the aphid eggs. Every one should test this for himself, and if it prove to be true in our climate as well as in the United States, it will be another strong argument in favor of using lime-sulphur.

The Bud Moth.

The part of the orchard which I sprayed in May was the part where the Bud Moths were worst. So far as I could see from comparing sprayed and unsprayed trees very few of these insects were killed. It is probable that all the larvæ were already out of their winter cases and were in the bursting buds and so escaped the spray. There is need of further experiments to determine the effect upon this pest.

The Codling Worm.

As a result of spraying with Paris green there are very few Codling worms in the College orchard; hence I could not determine the effect of the

wash upon them. It is difficult to see how these insects could be injured by the spray, yet some American Experimenters state that the wash does a good deal to control the Codling worm. The only case that I know of which would tend to show that the wash may greatly lessen the number of codling worms was at Fruitland in one of Mr. Tweddle's orchards. For some cause Mr. Tweddle sprayed about an acre of apple trees at one end of the orchard and situated just at the base of the mountain; the rest of the orchard was not sprayed with lime-sulphur, although both parts were sprayed with poisoned Bordeaux mixture later in the season. When I went through the orchard in September there were scarcely more than half as many wormy apples in the sprayed as in the unsprayed part. Mr. Tweddle attributes this result to the lime-sulphur. Possibly this was the case, but it would be necessary to make sure first that the later spraying with poisoned Bordeaux mixture had not been put on at exactly the proper time in this part and a little too late in the rest. Mr. Tweddle intends to make further experiments on this point next year. It is certain, however, that whatever benefit in this respect may be obtained, the wash will not completely control the codling worm; for in several orchards where it was used there was a very large proportion, about 50 per cent., of wormy apples.

Peach Leaf-Curl.

The evidence in proof of the lime-sulphur as a reliable preventive of Peach Leaf-curl is practically overwhelming. If any one has any doubt on the matter I refer him to such well known fruit-growers as Messrs. J. W. Smith, of Winona, Robert Thompson and W. H. Bunting, of St. Catharines. These and many other successful fruit-growers can, from their own experience, convince any man who is willing to be convinced.

Gooseberry Mildew.

It is well known that the chief difficulty in growing English gooseberries in America is that they are very subject to attacks of mildew, which practically destroys the leaves and fruit. Three years ago, almost by accident, Mr. Joseph Tweddle, of Fruitland, sprayed his English gooseberry bushes with lime-sulphur and was pleasantly surprised to find them comparatively free from mildew that season. Next year, and again this year, he has used the same wash with the same good results. This year Mr. E. D. Smith, of Winona, tried lime-sulphur on his bushes and agrees with Mr. Tweddle in saying that so far as their experience has gone the lime-sulphur makes the growing of this class of gooseberries both possible and profitable. Other fruit-growers in the Niagara district who have heard of these results told me they intended trying the experiment next year. Should these experiments turn out in the way it is expected no small benefit will accrue to the fruit-growers of the province.

Plum Rot.

Very few plums rotted this year, hence the effect of the lime-sulphur upon plum rot cannot to any appreciable extent be determined by this year's experiments. The general consensus of opinion, however, among those who have used the wash on their plum trees for several years, is that it has considerably lessened but not entirely prevented the disease.

Pear Scab.

An interesting experiment to determine the effect of lime-sulphur upon the Pear Scab, when applied much later than usual in the spring, was made by Mr. Doughbrough, of Vineland. Mr. Doughbrough, as I have mentioned above, sprayed some pear trees with lime-sulphur after the blossoms had fallen. These trees had been badly affected with Pear Scab the previous year. Some nearby trees were left unsprayed. The result was that the fruit on the sprayed trees was very much cleaner than on the unsprayed. He said that one could tell by a glance at the gathered fruit which belonged to the sprayed trees, and which to the unsprayed. I have not had an opportunity of finding the effect upon the disease of spraying at the usual date.

I have not been able in this one season to deal with all the problems that have suggested themselves to me in my study of this very useful spray. There are many fungus diseases yet upon which I have either no information or none that is valuable; for instance, apple scab, shot-hole fungus, and powdery mildew of cherry. Moreover the effect upon many insects and insect eggs has not been dealt with. No one orchard, probably no one district, affords an opportunity to make experiments upon all of the fungus diseases and insect pests which are to be found in this province. To get as full information as is desirable experiments must be carried on for several years and by several persons in different localities. The first year's work, though quite valuable in direct results, is perhaps even more valuable in showing what problems should be investigated and how to go about their investigation.

In conclusion there are a few points that should be mentioned: (1) It is clear that the trees treated with lime and sulphur ought to show a more thrifty appearance as a result. This was very conspicuous in many orchards and my attention was frequently directed to it by the fruit-growers. (2) No person should think that because lime-sulphur is such an excellent wash he need use no other spray. It must not be forgotten that lime-sulphur is only meant for a spring or fall wash and there are many fungus diseases and insects that can only be controlled by the use of a summer wash in addition. Poisoned Bordeaux mixture is, therefore, necessary to supplement lime-sulphur. In the careful use of these two spray mixtures lies the secret of much of the success of our best fruit-growers.

AN UNUSUAL OUTBREAK OF HALISIDOTA CATERPILLARS.

By Arthur Gibson, Assistant Entomologist, Experimental Farm, Ottawa.

One of the interesting outbreaks of the season of 1907, has been the unusual number of the caterpillars of two Halisidota Tussock Moths, viz., the Hickory Halisidota, *Halisidota caryæ*, Harr., and the Spotted Halisidota, *Halisidota maculata*, Harr. We have no record of these insects being so abundant and destructive in Canada, as they were during the past season. In the United States, the Hickory Halisidota Tussock Moth has, on several occasions, being recorded as doing much damage in limited localities. During the present year the Hickory Halisidota while numerous and injurious in Ontario and Quebec, was particularly destructive in the Maritime Provinces. The Spotted Halisidota, on the other hand, while also troublesome to some extent in Ontario and Quebec, was specially reported as doing harm in Mani-

toba and Saskatchewan. In the Ottawa district, both of these caterpillars were decidedly more in evidence than is usual and their work could readily be seen, chiefly on elm and basswood trees.

Many specimens and reports of injury by these insects have been sent in. The following extracts from some of the letters received at the Division of Entomology, will give an idea of the extent of the infestations.

THE HICKORY HALISIDOTA TUSSOCK MOTH.

Weymouth, N.S., August 15. "The caterpillars which I sent you on the 7th inst., and which you identified as those of the Hickory Tussock Moth, are very numerous on alder trees. To-day I noticed several trees which were covered from top to bottom with these caterpillars. I also found them on an apple tree, hundreds on a leaf." M. G. DeWolfe.

North Range, N.S., August 16. "I send you some caterpillars which are attacking the beech trees here. They move about from one limb to another. I am also told that they are on the apple trees near by, as well as on the beeches." F. V. McNeill.

Smith's Cove, N.S., August 15. "I am sending you some caterpillars. Please tell me what they are as they are eating the trees very badly. They are mostly on hardwood trees, birch and beech, but apple trees are also being injured." G. W. Potter.

Bear River, N.S., August 21. "Am sending you a small box containing samples of caterpillars that are numerous in some sections of Digby County. Please tell me what they are and give me a remedy for them." B. C. Clarke.

THE SPOTTED HALISIDOTA TUSSOCK MOTH.

Lancaster, Ont., August 28. "I found a large number of caterpillars, such as the one I am sending, on apple trees." A. G. McBean.

Brome Centre, Que., August 31. "I am sending a species of caterpillar which has been very numerous and very destructive here." H. H. Millar.

Brandon, Man., Sept. 13. "I am sending you some specimens of a caterpillar which I found quite common in many tree plantations during the past two weeks or more. This caterpillar is found most frequently on the Manitoba maples. I have also found it on Russian poplars, and some of the bush fruits, such as gooseberries and currants, are infested to quite an extent." F. W. H. Jacombe, Inspector of Tree Plantations, Dominion Forestry Branch.

Yellow Grass, Sask., Sept. 13. "The caterpillars which I send have been doing considerable harm by eating the leaves of ash-leaved maples." J. J. Odell.

Barronsfield, N.S., Sept. 16. "I send a caterpillar which seems very destructive. One Manitoba maple tree noticed particularly was completely covered with them." J. H. Seaman.

Mount Hebron, N.B. "I enclose a caterpillar which is abundant on apple trees in this vicinity." H. H. Biggar.

At Rostrevor, on Lake Rosseau, Muskoka, Ont., where I spent the first three weeks in September, the larvæ of the Hickory Halisidota were very abundant. In the rich woods of maple, birch, etc., near by, the caterpillars, which were wandering around in search of winter quarters, could be seen at almost every step. The Spotted Halisidota was also present at Rostrevor, but was not nearly so abundant. Such larvæ of the latter as were seen were all on alder.

From the above quotations, it will be seen that the abundance of these insects in 1907 was much commented upon and caused considerable anxiety. Fortunately, however, these caterpillars appear late in the season and, for

this reason, their injuries were not of such a serious nature as they would have been had the habits of the larvæ been different and the outbreak occurred in June or early in July, when the trees were making most growth.

The caterpillar of the Hickory Halisidota and that of the Spotted Halisidota are very different in appearance. The body of the former is clothed with dense tufts of white hairs, with a ridge of black hairs down the centre of the back, and two pairs of long black pencils on the 1st and 7th abdominal segments, while that of the latter is covered with tufts of bright yellow and black hairs, the black tufts being on the four anterior and three posterior segments and the yellow tufts on the remaining segments. The latter are centered down the middle of the back with a row of black spots. The larva of the Hickory Halisidota is slightly the larger of the two, measuring when full grown about an inch and a half in length.

Both caterpillars are general feeders, being known to attack a great many different kinds of plants. At Ottawa, we have found the larvæ of both species chiefly on elm, basswood, alder, willow, oak and ash. In his "Insects Affecting Park and Woodland Trees," Dr. E. P. Felt says that in New York State the caterpillars of the Hickory Halisidota show a decided preference for walnut, butternut and sumac. The larva of the Spotted Halisidota Tussock Moth is chiefly recorded as an oak-feeding species, in fact it is referred to by some writers as the Oak Tussock Caterpillar. When disturbed, both of these larvæ have the habit of falling to the ground and curling up, in which position they may remain for some little time.

When these two kinds of caterpillars become full grown in autumn, they wander about in search of suitable places to make their winter homes, and when such are found each larva spins an oblong oval cocoon composed of the hairs from its body. The cocoons of both species are of the same size, averaging a little over ¾ of an inch in length by about ½ an inch in width. They are different in colour, however, and owing to this can be easily separated. *Halisidota caryæ* has a cocoon of a uniform ashy gray colour, while the cocoon of *Halisidota maculata* is of a decided yellow, from the bright yellow hairs from the larva showing up among the black hairs, also from the

Fig. 28. The Hickory Halisidota Tussock Moth.

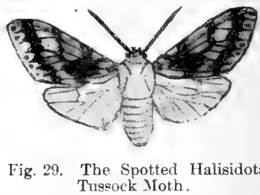

Fig. 29. The Spotted Halisidota Tussock Moth.

body of the caterpillar. In some specimens of the latter the yellow is more intense than in others, this of course being caused by more than the usual number of the yellow hairs on the larva. At the present time these cocoons can be readily found in open woods, etc., under pieces of old plank, dry logs, or even stones. On October 8th of the present year, I collected 13 cocoons of the Hickory Halisidota, fastened to the underside of a small piece of board. This was near a large basswood tree on which the larvæ had been feeding. Many other cocoons occurred near by.

Soon after completing its cocoon the caterpillar changes to a reddish-brown pupa, the moths emerging the following June. The Hickory Halisidota Tussock Moth (Fig. 28), measures when the wings are expanded from

1½ to nearly 2 inches. The ground colour of the forewings is ochre-yellow, but is heavily dusted with brown scales. On the forewings are five, more or less, transverse bands, or rows of spots joined together. The outer two rows of these are pearly, the others mostly the ground colour of the wings, edged with brown. The hind wings are paler, semi-transparent, and without any markings. The body is about the same colour as the wings, the shoulder covers of the thorax being margined with brown on the inside. The male differs from the female in being rather smaller and in the antennæ being more pectinate.

The Spotted Halisidota Tussock Moth (Fig. 29), is a more conspicuous looking moth. The forewings are also ochre-yellow, but are spotted with blotches of dark brown, the outer of which forms a distinct band across the wing. The other blotches form four partial transverse bands, the 2nd, 3rd and 4th of which, in most specimens, join in the centre of the wing, forming one large blotch. The hind wings are the same as those of *H. caryæ*. The body is of much the same colour as the forewings, and just behind the collar are two oblique stripes, which converge and almost form a V-shaped mark. In width of wing expanse, this species averages slightly more than the first named species. The same differences occur between the males and females.

As mentioned above, the caterpillars of these two Halisidota Tussock Moths only appear late in the season, but, if another year they should again occur in such numbers on trees of value which it was thought should be protected throughout the whole season, they could, of course, be easily destroyed by spraying the trees with a poisonous arsenical spray, such as Paris green one pound, fresh lime one pound, water 160 gallons. In apple or other orchards which are regularly sprayed with the poisoned Bordeaux mixture, little injury would be done by these and many other kinds of leaf-eating caterpillars.

ADDITIONAL INSECT GALLS OF ONTARIO.

By Tennyson D. Jarvis, Ontario Agricultural College, Guelph.

In last year's Annual Report,* I gave an account of a considerable number of Insect Galls found in Ontario. Further collections and investigations have enabled me to add the following to the list:—

Diptera.

The Iris Leaf Gall. (*Agromyza magnicornis*) (Lowe).

An oval enlargement on the inside of the leaf, usually about 1 in. from the tip. Length ½-¾ in., width ⅛ in., thickness, ⅓ in. Surface green, like that of the rest of the leaf, except that it is somewhat whitened and withered in appearance. The interior is composed of loose, parenchymatous tissues separated from one another by many air cavities. In the centre is a single chamber about ⅓ in. long and ¼ in. in diameter. Where the gall occurs the leaf broadens, but above the affected part it becomes distorted and dwarfed. Larva, white. Pupa, dark brown. Occurs on the Blue Flag (*Iris versicolor*). Common.

Aspen Egg Gall. (*Agromyza æneiventris*, Fallen). Plate A., fig. 8.

This gall resembles in external appearance the Egg Galls of the willow

*Thirty-seventh Annual Report of the Entomological Society of Ontario, 1906, pages 56-72.

and Basswood, but sometimes it more nearly encircles the branch or twig. In form it is irregularly oval, about ⅓ to ½ in. long, ¼ to ⅓ in. wide and ⅛ to ⅓ in. high. The texture is pit-like. The surface, at first smooth and like that of the bark, grows rougher as the gall matures. Polythalamous. The larvæ are greenish, about 3 mm. long and 1 mm. thick. It occurs, usually, singly but often with two united in a straight line, on the terminal branches of the American Aspen (*Populus tremuloides*). Fairly common at Guelph.

The Willow Potato Gall (*Rhabdophaga batatas*, O. S.) Plate A., fig. 7. An oblong ovate gall about 1 in. in length and ⅓ to ½ in. in thickness. The surface is irregular, but for the most part fairly smooth. The color is similar to that of the bark at first, but turns gray when mature. The texture is pith-like, but fairly hard. The gall is polythalamous. The larvæ are small and pinkish. It occurs singly usually, but sometimes with two or more in close proximity on any part of the twigs of the Scrub Willow (*Salix* sp.). Common.

Cock's Comb Hawthorn Gall (*Hormomyia cratægifolia*, Felt). Plate A, fig. 4.

This gall is very similar to the Cock's Comb Gall on the Elm (*Colopha ulmicola*). It is on the upper surface of the leaf and has the appearance of two tiny leaflets about 4-6 mm. high and 8-10 mm. long growing up parallel to each other but at right angles to the surface of the leaf. The upper margin of each is crenate usually, but sometimes the two leaflets coalesce at the top and become thickened in this part. They are green in appearance and of the same texture as the rest of the leaf. On the under surface, there is usually a considerable depression or groove on each side of the base of the gall. Of the infested leaves examined, none had more than two galls to a leaf. Monothalamous; contains a single white larva tinged with yellow. Occurs on the Hawthorn (*Cratægus* sp.). Rather rare.

Elm Leaf-fold Gall. (*Cecidomyia ulmi*, Beuten.) Plate A, fig. 1.

The gall takes the form of a pulpy thickening of the tissues in the undersurface of the leaf, extending for some distance along the midrib. It is usually near the base of the leaf, and causes the upper surface to double on itself instead of expanding in the ordinary way. The enlargement varies in length from about ¼ tol in. and usually extends about ¼ in. on each side of the midrib. It is about 2 mm. thick. The surface is pubescent like that of the rest of the leaf, but is more or less irregular, with ridges and hollows, often appearing as though two or three galls were joined together. On the upper surface of the leaf the pocket found opposite to the enlargement on the lower surface contains several small white larvæ which have a slight pinkish tinge. The gall occurs on the American Elm (*Ulmus Americana*). Fairly common this year, 1907.

Balsam Fir Needle-Gall. (*Cecidomyia balsamifera*, Lintner). Plate A, fig. 3.

This is an irregularly oblong gall, situated near the base of the needle on the new growth. It encircles the needle, is about 3 mm. long, and from 1 to 2 mm. thick. The surface in most cases is smooth, though often somewhat corrugated, especially on the under surface. The color is a little paler green than that of the needle and the texture somewhat looser and more pulpy. The gall is monothalamous and contains a single orange-colored larva which (August 5th, 1907) had not yet begun to pupate. There is usually only one gall to a needle, but sometimes two continuous ones are found. Occurs on the Balsam Fir, (*Abies balsamea*). Rare.

Dogwood Leaf Gall. (*Lasioptera corni*, Felt.). Plate A, fig. 2.

Thin-walled circular elevations on the under side of the leaves of Cormus. Somewhat bladder-like in appearance, and sometimes occurring in

great numbers. A light-colored areola surrounds the gall which is monothalamous and contains a small larva which moves about quite actively when disturbed. Generally about .5 cm. in diameter. Not commonly distributed but, when found, occurring in great numbers. Late July and August. Found on Cornus sp. Common at Guelph.

Willow Joint Gall. (*Rhabdophaga nodulus*, Walsh). Plate A, fig. 9.

A rather small, irregularly, oval enlargement of the stem at the joints or nodes, about ⅓ to ½ in. in length and ¼ in. in diameter; the texture is woody; the surface smooth and like that of the bark; monothalamous. It occurs on the stem and branches of the Scrub Willow (Salix sp.). Fairly common at Guelph.

Hickory Cone Gall, (*Cecidomyia sanguinolenta*, O.S.).

This is a conical or sometimes almost spherical gall, situated on the under surface of the leaf along the veins. It is much constricted at the point of attachment with the leaf. Height about 4 mm., greatest diameter 3 to 4 mm., surface even, slightly pubescent, color at first red or purplish, later turning brown, monothalamous. The surrounding walls are nearly 1 mm. thick and of close, firm texture when mature. Numerous galls are usually found on a single affected leaf. They occur on the Sweet Hickory (*Carya alba*). Common in some localities.

Hickory Seed Gall, (*Cecidomyia caryæcola*, O. S.).

This is a conical gall with a fine, elongated tip. It is about 5 to 6 mm. in length and 2 to 3 mm. in greatest diameter, is smooth, pale green, turning brown in autumn, monothalamous; the enclosing walls are about .5 mm. thick, close and firm in texture when mature. It is found singly or in large numbers along the veins on the under side of the affected leaves of the Sweet Hickory, (*Carya alba*). Common in some localities.

Grape Vine Tomato-Gall, (*Lasioptera vitis*, O. S.).

"Consists of a bunch of irregular swellings of various rounded shapes. Soft, juicy and succulent. Yellowish green, tinged with red or entirely of this color. On stems and leaf stalks of Wild Grapes. May and June. Common." (Beutenmuller). I have not seen the gall myself, but it is reported from Ottawa by Dr. Fletcher, in the Report of the Entomologist and Botanist for 1887, page 29.

Bunch Gall on Willow. (*Rhabdophaga brassicoides*).

This is a gall of the same type as *Cecidomyia solidaginis*. It consists of a bunch of massed leaves which surround a small cell containing a yellowish larva. Growth having been checked at the end of the stem, this cluster of leaves has been formed. Occurs on Scrub Willow (Salix sp.). Not common.

Goldenrod Terminal Gall (*Asphondylia monacha*, O. S.).

This gall occurs at the tip of the plant and is a leafy conical structure ½ to 1½ in. high and ½ in. in diameter. It consists of many leaflets clustered together and having their basal parts thicker than the part above. This thickened part forms the broad base of the cone, and the thinner part immediately above being incurved completes the conical structure. Above this conical foundation the tip of the leaflets extends to a greater or less degree and forms a sort of rosette. Between the thickened parts of the leaflets live from one to many small yellowish white, or in some stages almost orange, larvæ. The gall occurs on the Goldenrod (*Solidago Canadensis*). Common.

Willow Bud Gall, (*Rhabdophaga triticoides*, Walsh).

This gall seems to be an altered or transformed bud. The bud scales become elongated and the interior becomes a cavity in which the larva lives. The gall is about 5 mm. long, 2 mm. wide, and 1 mm. thick; the side against the stem is flattened. The color and surface are like those of the stem itself. Monothalamous. It occurs on the twigs of the Scrub Willow (*Salix* sp.) and

usually causes the stem to bend at the infested point. Common in some localities near Guelph.

Lunate Marginal Gall. (*Choristoneura flavolunata*, Felt). Plate A, fig. 6.

Circular or somewhat irregularly elliptical spot-like galls only projecting very slightly from each side of the leaf. They are about 1-5—2-5 inch in diameter, the main part of the spot is light colored (usually yellowish), this being enclosed by a dark ring, thus giving it some resemblance to an eye. The galls are glabrous and monothalamous, the larvæ feeding on the internal tissue of the leaf without causing much projection from within. Usually not more than 1 to 2 spots on each leaf. Occurs on *Solidago Canadensis*. Common at Guelph.

Blackberry Leaf Gall, (*Cecidomyia farinosa*, O. S.).

Consists of woody swellings at the base of the leaflets or on the midrib of the blackberry. The larvæ are purplish in color. Rare at Guelph.

Boneset Stem Gall (*Choristoneura perfoliata*, Felt.) Plate A, fig. 5.

Consists of oval swellings of the stems and leaf stalks. When mature, the enlargement is about twice the normal size of the stem. The gall is monothalamous and contains red larvæ. Fairly common at Guelph.

Spiræa Pod Gall (*Cecidomyia salicifoliæ*, O. S.).

The Pod Gall of the Meadow Sweet is found not only on *Spiræa salicifolia* but also on *S. tomentosa* and *S. betulæfolia*. It is quite similar in shape and appearance on all three, and in each it is found on the under surface of the leaf as stated in Entomological Report of 1906, page 68.

Golden-rod Gall (*Trypeta polita*, Loew).

Consists of a bunch of dwarfed leaves caused by the arrest of the growth of the branches. It is a little more than half an inch in length. The larva lives at the base of the gall. Fairly common at Guelph. On Golden-rod (*Solidago Canadensis*).

Hymenoptera.

The Large Spiny Rose Gall (*Rhodites multispinosus*, Gill). Plate B, fig. 3.

This gall, when mature, is oblong or sometimes ovate in shape, and is found on the stem and the branches. It averages 1 to 2 in. in length and ¾ to 1 in. in thickness in the widest part. The surface is covered with numerous spines or prickles about ¼ in. long and is light brown colored. The surface of the gall itself is somewhat rough and irregular, with depressions and elevations sometimes of considerable size. Moreover, after the gall-insects have emerged it is perforated with from 30 to 50 small, circular apertures, each about 1.5 mm. in diameter. The color of the gall is a dull gray. Its texture is firm, hard, brown colored, and granular. The gall is polythalamous, containing from 30 to 50 chambers, each about 3 to 5 mm. long and 2 mm. wide and arranged more or less radially along the longitudinal axis. When mature, the gall-insects make a tunnel from these to the surface. The adult insect is a Cynipid about ¼ inch long with reddish colored head, thorax and abdomen. The gall occurs on the Wild Rose. Rare; Niagara District and Toronto.

Cinquefoil Axil Gall (*Diastrophus potentillæ*, Bass). Plate B, fig. 5.

The gall is spherical or oval in shape, from ¼ to ½ inch in diameter and about ½ inch long, and is borne on a slightly curved peduncle 3-5 to ½ inch long arising in the axil of the leaves. The gall is spongy in texture, with a solitary central chamber containing the white curved larva which is about 3 mm. in length. The gall is green in summer, reddish brown in winter. Occurs on *Potentilla Canadensis*. Rare in Eastern Ontario.

Blackberry Seed Gall (*Diastrophus cuscutæformis*, O. S.).

Consists of hard, woody, somewhat globular seed-like bodies 2 to 4 mm. in diameter. More or less covered with curved spines which are about 2 mm. long. Yellowish green or olive in color and borne in clusters on the stem, each gall containing one chamber. Rare at Guelph. Occurs on Blackberry (*Rubus villosus*).

Raspberry Stem Gall. (*Diastrophus turgidus*, Bass). Plate B, fig. 2.

A large reddish-brown polythalamous, tubercular or irregular gall, about 1 to 1.75 in. long and .5 in. in average diameter, arising abruptly on the stem. Green in summer, darkening towards winter. Chambers are very numerous, oval in shape, 1.5 to 2 in. in width and 2.3 in. deep. The gall has a number of prickles scattered over it which are about 2 to 3 mm. long, and appear to be enlarged stem prickles.

Oval Willow Stem Gall (*Euura S. nodus*, Walsh).

"A mere general enlargement of a twig from one-quarter more than its normal diameter up to twice its normal diameter, almost always without any abnormal roughness on the external bark, and not always confined to one side only of the twig. General color that of the twig. When cut into (August 28th), the interior of each gall is found to be pithy and to contain 1 to 3 larvæ in separate cells. Frequently on a piece of twig 6 in. long, 2, 3, or 4 of these galls are placed at irregular intervals. No appearance internally of any transverse plates or transverse fibres as in *S. ovum* and *S. ovulum*. Length .75 to 1.50 in., diameter .10 to .25 in. Very like the Cecidomyidous gall, *S. nodulus*, on the same willow (Proc. Am. Ent. Soc., Philada., III, p. 600) but is much larger, is polythalamous instead of monothalamous" (Walsh). The specimens found at Guelph were from .50 to .75 in. in length. The adults of any specimens examined on May 30 had emerged. Occurs on the Scrub Willow (*Salix sp.*). Common in some localities.

Rose Leaf Nipple Gall, (*Rhodites lenticularis*, Bass).

This is a small circular gall of about 3 mm. in diameter. The upper surface is practically on a level with the surface of the leaf and is pale green in color. It is characterized, however, by the presence of a little nipple in the centre, the nipple often being of a purplish shade. The under surface is slightly raised beyond the rest of the leaf and, unlike the upper, is purplish in color and has a slight depression in the centre corresponding to the nipple above. The galls occur singly or, more commonly, in groups, often covering the whole leaf and making its surface uneven. Found on the Rosebush (*Rosa* sp.). Rare.

Oak Wart Gall (*Andricus futilis*, O. S.). Plate B, fig. 4.

This is a rather small, wart-like gall situated in the parenchyma of the leaf and protruding beyond both surfaces, but chiefly beyond the lower. The protuberance on the lower surface is roughly hemispherical in form, averaging 4 mm. in diameter and 2 mm. in height. Its surface is often smooth and even, but quite often it is uneven or pebbly. The color is considerably lighter than the rest of the under surface of the leaf. The protuberance on the upper surface is much the same shape and nature, but is not so high as a rule, being usually only about 1 mm. in height. Its color is also lighter than the color of the surrounding part of the leaf, but darker than that of the under side of the gall. The walls of the gall are thin and much the same texture as the parenchyma of the leaf. The interior contains a kernel composed of two small oblong cells joined together along the side parallel to their longitudinal axis. Each cell has a small cavity within it containing a single, small, white larva. The adult insects emerged about July 30, 1907, and were small, reddish Cynipids. One to several galls may occur on a leaf. They

are found either on Burr or White Oak. (*Quercus macrocarpa* and *Quercus alba*). Common.

Burr Oak Leafy-wreath Gall (*Andricus topiarius*, Ashm). Plate C, fig. 6.

This gall resembles in external appearance the Goldenrod Bunch Gall (*Cecidomyia solidaginis*). It consists of a cluster of dense, narrow leaflets springing from a bud. When mature several small, brownish pupal cases about 3 mm. long and 2 mm. wide can be seen among the leaflets, attached at the base to the woody tissues below. The larvæ are minute and whitish. It occurs on the terminal twigs of the Burr Oak (*Quercus macrocarpa*). Common.

Oak Knot Gall (*Andricus punctatus*, Bass). Plate C, fig. 1.

This is a rough, hard, woody, somewhat globular, knot-like gall encircling the stem and varying greatly in size, but commonly 1 to 2 inches in diameter. The surface is ashy brown in color, and rough, with almost a network of little ridges and depressions. Polythalamous. It occurs on the branches of the Scarlet Oak (*Quercus coccinea*). Common.

Oak Seed-Gall (*Andricus seminator*, Harr.).

This is a woolly gall encircling the stem. It is irregularly oval, $\frac{1}{2}$ to $1\frac{1}{2}$ in. in diameter and $\frac{3}{4}$ to 2 in. in length. Polythalamous, containing many cream-colored cases attached to the twig, each case looking very like an oat seed. Early in the season the gall is white, but later it becomes brown. Occurs on the twigs of the White Oak (*Quercus alba*). Puslinch Lake. Rare.

Pine-cone Oak Gall (*Cynips strobilana*, O. S.). Plate C, fig. 4.

This gall is formed in the axil of a lateral bud just at the base of the terminal bud-cluster. When viewed from some little distance, it appears like a solid globular structure about $\frac{1}{2}$ in. in diameter, but when more closely examined it is found to consist of a rosette, or head of hard, brown, nut-like, wedge-shaped structures fitting closely to one another and attached at the base to a small spherical receptacle about $\frac{1}{4}$ to $\frac{1}{3}$ in. in diameter. Inside of each of these nutlets there is a single chamber, containing but one white larva. Occurs on the terminal twigs of the Burr Oak (*Quercus macrocarpa*). Common at Guelph.

Oak Fig Gall (*Biorhiza forticornis*, Walsh). Plate C, fig. 2.

A group of many small, soft, bladder-like, one-celled structures, each about 1-3 in. in diameter. These are often compared to a bunch or cluster of pressed figs, but seem to me to resemble more nearly the honeycomb of the bumble-bee, except that they are pale yellow in color, sometimes tinged with red, turning yellowish brown in autumn. They are arranged in a cylindrical cluster along the stem of the branches or twigs. The cluster is 1 to 2 in. long and $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter. The interior of each one of these bladder-like bodies is loosely filled with woolly fibres which keep in its position the small larval cell. Occurs on the twigs of the White Oak (*Quercus alba*). Common in some localities.

Empty Oak Apple (*Amphibolips inanis*, O. S.).

This oak apple gall is very similar in external appearance to *Amphibolips confluentus* (Harr.) but is considerably smaller and is quite dissimilar in its internal structure. It is found on the under side of the leaf, and springs from one of the main veins, is nearly spherical in form, about $\frac{1}{2}$—5-6 in. in diameter, and has a smooth, glossy, light brown surface when mature, which earlier in the season is green. The walls which enclose the almost empty interior are very thin, somewhat parchment-like and brittle. The small spherical larval cell within the cavity is about $\frac{1}{4}$ in. in diameter and

is held in position by a comparatively small number of filaments which radiate from it to the surrounding walls. It occurs on the Red Oak (*Quercus rubra*). Rare.

White Oak Club Gall (*Andricus clavula*, Bass). Plate C, fig. 3.

This is a club-shaped gall situated at the tip of the twigs. It evidently originates in the terminal bud-clusters, which it prevents from developing, though occasionally a few leaves grow out from the gall itself. When mature, it is $\frac{1}{2}$ to 1 in. long, hard and woody in texture, a little darker in color than the rest of the bark, and somewhat grooved and ridged. Very often a second, or even a third, somewhat smaller gall is formed from the lateral buds immediately below. The terminal gall, in the cases examined, was dithalamous, the lateral ones monothalamous. It occurs on the White Oak (*Quercus alba*). Common in Muskoka.

Willow Petiole and Leaf-base Gall (Saw-fly)—*Pontania desmodioides* (Walsh).

This gall has the form of an oblong enlargement of the petiole, or often of the midrib of the leaf near the base. It is 8 to 15 mm. long and 4 to 6 mm. in diameter. Surface smooth and glossy, like that of the leaf; occasionally, however, it is somewhat rugose and irregular. The gall is solid and of a pulpy texture. It was monothalamous on July 8th, the date of discovery, the cavity being very small and containing a tiny greenish-white transparent larva with a brown head. Occurs on the Willow (*Salix lucida*). Rare, at Guelph.

Red Oak Gall (*Andricus papillatus*). Plate C, fig.5.

This gall is red and projects on both sides of the leaf. It is round and about 4 mm. in diameter. Above dark red, below yellowish. About three times the thickness of the leaf. On Red Oak at Puslinch Lake. July.

Spiny Ball Gall on Wild Rose leaf.

The gall described as *Rhodites bicolor* (37th Annual Report, page 70, Plate E, fig. 2), has been identified by Mr. Wm. Beutenmuller as *R. nebulosus*.

LEPIDOPTERA.

Golden Oval Stem Gall (*Eucosma Scudderiana*, Clem.). Plate C, fig. 7.

This gall is situated on the stem and is oval in form, about 1 cm. long and 4 to 5 mm. in diameter. Its surface is similar to that of the stem, but the color is a little darker around the central part. It is pithy in texture and monothalamous. At the date of writing, July 24th, the chamber was small and cylindrical, and contained a single orange-colored larva. The galls are found either singly or often with two united and forming an irregular elongated enlargement. They occur on the Goldenrod (*Solidago* sp.). Common in Muskoka.

HEMIPTERA.

Plum Gall on Elm (*Pemphigus ulmi-fuscus*). Plate C, fig. 8.

This attractive looking gall occurs on the upper surface of the leaf and resembles in shape an unripe cherry or plum, there being an upper glossy green drupe-like part and a short stem connecting this with the leaf. The drupe-like part is slightly oblong in most cases and varies in length from 8 to 10 mm. and in thickness from 5 to 7 mm. The stem is from 3 to 4 mm. long and 2 to 3 mm. thick. The gall is monothalamous; a rather thin outer covering about 1 mm. thick and somewhat firmer in texture than the leaf encloses a large, round cavity, in which a single mother insect brings forth her brood of many young. The part of the leaf from which the gall springs is drained

of its nourishment and becomes whitish and roughened or blistered on both sides. Occurs singly on the leaf of the English Elm (*Ulmus campestris*). Rare.

NOTE. There is a very similar gall on the Red Elm, but differing in the following respects: (1) It is twice as large; (2) Its texture is a little thicker; (3) The surface is rough, like the leaf, not glossy; (4) The part of the leaf around the base is quite normal in appearance, showing no signs of being weakened through lack of nourishment or any other cause. Probably the difference in the vigor of the two kinds of trees and in the character of leaf will account for these differences in the galls.

Hickory Hemispherical Gall (*Dactylosphæra hemisphericum*).

This gall is nearly hemispherical in shape, is formed in the parenchyma of the leaf, and the main part of it projects above the upper surface. It varies in size, being from 4 to 10 mm. in diameter and 3 to 5 mm. in height. The color is usually pale green, often changing to a reddish shade on most of the upper surface of the gall. After maturity the gall withers and becomes dark brown and dead looking, thus greatly disfiguring the leaf. The upper surface of the gall, before it has begun to wither, is slightly roughened by a few depressions and elevations. The under surface is of a paler color, being greenish-white. It does not project beyond the surface except at the small aperture, which is a slit about ⅓ of the total diameter in length. Both sides of this slit project a little beyond the rest of the base of the gall and are reflexed so as to form a mouth-like structure. The gall is monothalamous. The walls are nearly 1 mm. thick and are somewhat hard and tough in texture. There may be only one or many galls on a single leaf. In most cases where they are abundant they seem to arrange themselves in rows along the midrib, often two deep on each side. Occurs on Shell-bark Hickory (*Carya alba*). Common.

ERIOPHYIDÆ.

Buttonwood Gall (*Eriophyes cephalanthi*).

This gall usually has the form of a number of small protuberances from 1 to 3 mm. high, which have coalesced at the base into one irregularly shaped cluster. The size and extent of a cluster varies greatly; sometimes a very small part of the leaf, less than one-eighth in some cases, is affected; at other times several large clusters are found on the same leaf, and occasionally the whole leaf is covered with galls. The galls are usually of a little paler shade of green than the rest of the leaf, but the top is often reddish in color. The texture is somewhat thicker and firmer than that of the leaf. The under surface of the leaf at the affected part is usually depressed, is rough and covered with a white pubescence. The gall occurs on the Buttonweed (*Cephalanthus occidentalis*). Common in Muskoka.

Ball Gall of the June berry (*Eriophyes* sp.). Plate D, fig. 1.

This is a small, nearly globular gall averaging about 2 mm. in diameter. It is found either singly or in clusters on any part of the upper surface of the leaf. On the lower surface the presence of the gall is indicated by a very small protuberance which is covered with a hoary pubescence. The main part of the gall, as seen on the upper surface, is dark brown in color, has a slightly roughened surface and is covered with a similar pubescence to the part on the lower surface. It is monothalamous. The walls of the chamber are thin (about 2 mm. in thickness), firm, and somewhat leathery in texture. The chamber is spherical. The gall is rather broadly attached to the leaf, the constricted part being about ⅔ of the total diameter of the gall. It occurs on the June berry (*Amelanchier rotundifolia*). Rare.

The Unsightly Willow Gall, (*Eriophyes* sp.) Plate D, fig. 5.

This far-from-beautiful gall seems in most cases to spring from the axils of the leaves; occasionally, however, it is formed on the leaf itself. Often several galls are formed near the end of a twig. In these cases probably they started in the axils of the leaves which were subsequently absorbed into the galls themselves. Where the galls occur near the terminus of a twig, they are usually thickly clustered and encircle the stem, whose longitudinal growth becomes checked in such cases. The galls vary greatly in size and compactness of structure. Occasionally one is found that has the appearance of a small rosette, about ⅓ to 1 inch in diameter, composed of tiny, thickened leaflets covered with a whitish pubescence, the basal half of the leaflets being grown together and only the upper half being separate. In other cases a number of smaller galls are loosely clustered into one fairly large group, often an inch or more long. In other cases only a single diminutive gall is found. The galls, especially where loosely clustered, look considerably like the flower or fruit clusters of Lamb's Quarter (*Chenopodium album*), or like a very irregular whitish green fungus growth. In fall and winter they become grayish black and, where numerous, disfigure the tree considerably. They occur on the Scrub Willow (*Salix* sp.). Rare, except in a few localities.

Chestnut Leaf Gall (*Eriophyes*, sp.).

A small gall projecting from both sides of the leaf. When found along the side of the leaf-vein it is hemispherical, elsewhere is more or less spherical. The diameter is about 2 to 3 mm. Somewhat the larger half of the gall is on the upper surface. The color at first is green, but turns brown when mature. Monothalamous. Occurs on the Chestnut (*Castanea sativa*). Common.

Convex Gall of Poplar (*Eriophyes sp.*). Plate D, fig. 3.

This gall has the shape that one imagines would be formed if he were to press the tip of the little finger, or of some round instrument, against the lower surface of the leaf and, without breaking the tissues, were to cause them to yield until there was a decided depression on the lower surface and a corresponding bulge on the upper. There is practically no thickening of the tissues of the leaf or change in color except that the under surface of the gall is orange yellow. The depression varies in size, being about 4-12 mm. in diameter and 2-5 mm. in depth. Occurs on Lombardy Poplar (*Populus dilatata*). Rare.

Walnut-leaf Wart Gall (*Eriophyes sp.*).

A warty protuberance chiefly on the upper surface of the leaf, constricted at the base, about 2-5 mm. high and 2-3 mm. thick in its widest part; surface usually very uneven with many depressions and elevations; color green; texture of outer part somewhat pulpy but most of the interior is composed of a mass of loosely woven silvery fibres or strands. This gall resembles greatly the Elm-leaf Wart Gall (*Eriophyes ulmi*), but has a rougher surface at the top and is not frequently found on the under surface of the leaf. Occurs on black walnut (*Juglans nigra*). Common.

Walnut-Cushion Gall (*Eriophyes sp.*). Plate D, fig. 2.

Large and somewhat cylindrical in outline. Found on the lower portion of the petiole (in some cases the pulvillus is affected). A green solid swelling clothed by a dense fur-like covering of short reddish hairs about 1 mm. in length. The galls usually appear on the upper side of the petiole, with the edges overlapping. 8-10 mm. long and 4-8 mm. broad, but varying considerably in size. On black walnut (*Juglans nigra*).

Unsightly Poplar Stem-gall (*Eriophyes sp.*).

This is one of the most irregular and unsightly of all our galls. It is found on the stem of young twigs though sometimes it extends to the basal

part of an adjoining leaf or leaves. It seems always to start in the axil of a leaf. The stem gradually thickens at the affected part to almost three times its normal size and does not continue to elongate in this part as it does above and below it; so that in a space of 1 to 2 inches where we should normally find not more than four leaves, we here get eight or nine, some of them dwarfed and distorted. Moreover the stem at this point, instead of growing straight out in its normal direction, often becomes distorted and bent in another direction, sometimes nearly at right angles to its former course, and then coming back to its first direction grows on parallel to it. The gall itself looks like a very irregular tubercular mass of closely packed small reddish-green protuberances about ¼ inch high. These irregular masses in some places encircle the stem, in others are chiefly on one side of it though often extending to the basal part of the leaves. Sometimes the masses are so close as to be continuous, at other times they are ¼ inch or more apart. The whole of the affected part of the stem is usually from ½ to 1¼ inches in length, and the irregular mass when surrounding the twig makes the total diameter ½ to 1 inch. Later in the season and during the winter the gall is black and the part of the stem above it in most cases dies. There is usually but one gall on a stem, but sometimes a second or third occurs at some distance below it. This gall is somewhat similar to what I have called the unsightly Willow Gall, described above. It occurs on the American Aspen (*Populus tremuloides*). Rather rare.

Speck Gall of Chokeberry (*Eriophyes sp.*)

This gall, as the name indicates, is a very tiny, speck-like structure, usually much smaller than the head of a pin but occasionally a little larger. It is visible equally on both sides of the leaf and, when mature, is of a brown color. In none of the numerous specimens observed did it extend more than .5 mm. beyond the surface. The gall resembles very much a species of Eriophyes gall found on the hawthorn. Numerous galls, scattered here and there throughout the parenchyma, are usually found on each infested leaf. They occur on the chokeberry. (*Pyrus melanocarpa*). Common in Muskoka.

Grape Leaf Wart Gall (*Eriophyes sp.*).

This is a small semi-circular, or sometimes nearly circular, wart-like gall situated along the veins of the leaves. It is about 2 mm. in diameter and only very slightly elevated beyond the plane of either surface of the leaf. The upper surface is fairly smooth and slightly paler in color than the rest of the leaf. The under-surface is of much the same color and kind of surface as the underside of the leaf, but it has a tiny white nipple in the centre, and around all the gall, except the part touching the vein, there is a distinct depression or furrow. There are often several galls on a single leaf. They occur on the Wild Grape (*Vitis cordifolia*).

Pin Cherry Gall (*Eriophyes sp.*).

Oblong or club-shaped, reddish projections scattered over the leaves, somewhat irregular in outline and pubescent, 3-4 mm. long .5-1 mm. diameter, being broadest at the top. Generally borne on a little curved peduncle-like portion which is about 1 mm. long and lighter in color.

In conclusion the writer desires to express his thanks to Dr. E. Porter Felt, Mr. William Beutenmuller, and Prof. Bethune who have most kindly aided in the preparation of this paper. Especial recognition must be given to Mr. L. Cæsar, who has assisted in describing many of the species. I am much indebted to Mr. W. R. Thompson and Mr. C. D. Jarvis, who have furnished the photographs for this paper.

INJURIOUS INSECTS IN ONTARIO IN 1907.

By C. J. S. Bethune, Ontario Agricultural College, Guelph.

Owing to the prolonged cold weather during April and May the season of 1907 was remarkably backward and the appearance of our common insect pests was much later than usual. Many kinds were no doubt greatly reduced in numbers by the change from very warm days during the last week in March, which caused them to come out of their winter quarters, to the abnormal cold of the following two months. A drop of 50 degrees of temperature between the 29th of March and the 1st of April must have been a severe trial of the vitality of the early appearing species and large numbers must have succumbed to it. But notwithstanding these losses, most of our familiar insects were to be found during the season, while some were conspicuous by their absence. Among the latter may be mentioned the Squash-bug (*Anasa tristis*), which has entirely disappeared in this part of the province, though one of our most abundant pests only a few years ago. The season was marked by one great outbreak of the Variegated Cut-worm, a full account of which is given in another part of this report.

Fruit-Tree Insects.

Among insects affecting fruit, none has been more complained of this year than the codling-moth, which has taken its heavy toll from orchards throughout the fruit-growing districts. The greatest amount of damage has been inflicted in those localities where there is a second brood of the worms. Careful spraying twice in the spring with poisoned Bordeaux mixture followed by the prompt removal of all fallen fruit, should reduce the second brood to a minimum, and what survives may be successfully dealt with by bandaging the trees from the middle of July, and destroying regularly the worms that take refuge under them. These operations certainly involve much trouble and expense, but it has been many times proved that they pay well in clean marketable fruit and plenty of it. There are still some points in the life history of the codling-moth about which we continue in doubt and many careful observations in different localities are required to clear them up. Recent discussions among our most practical fruit growers show that interest in these matters has been awakened, many various opinions have been expressed and painstaking investigations may be expected. Any positive results will, no doubt, be made known at once.

Another insect that threatens to spread over the province is the Apple Maggot (*Rhagoletis pomonella*), which is quite as injurious to the fruit as the codling-worm. In the central part of the State of New York, in Connecticut and Vermont, and as far north-east as Maine, this is now a most serious pest. In many localities it is impossible to find an apple free from the attack, which spoils the appearance of the fruit and renders it worthless. So far we have only seen specimens in this country from the neighborhood of Bowmanville, and Dr. Fletcher last year recorded its presence in injurious numbers in the county of Prince Edward. Having now obtained a foothold, it is to be feared that its range will soon be extended over a wide area and that fruit-growers will have another just cause for lamentation. The damage is caused by a small white slender maggot, which burrows in all directions through the fruit, turning the flesh brown wherever it goes; it takes about six weeks to mature and then it usually causes the fruit to fall, in which case it leaves the apple and enters the ground. The parent is a small, two-winged fly, prettily marked with bands and with

golden eyes. The female punctures the fruit with her ovipositor and inserts the egg beneath the skin, consequently spraying with any poisonous mixture is of no avail. The emergence of the parent flies and their egg-laying is very irregular and may take place at any time during the summer and even when the fruit is fully formed. When this is the case apples apparently sound when picked may later on become worthless from the working of the unsuspected maggot within. Thus it may be seen that this is a very serious pest and most difficult to deal with. The only remedy so far known is to destroy all fallen fruit without delay: this should be done daily in order to give no time for the maggots to escape into the ground. The cheapest and most effective plan is to let growing pigs have the run of the orchard: they will keep the ground clear of fallen fruit and will thus devour both these maggots and the codling-worm as well

Scale Insects. An unusually large number of enquiries have been made this year respecting scale insects and a number of different kinds have been received for identification. This does not necessarily mean that these insects have been more abundant than in previous years, but rather that fruit-growers have paid more attention to them and are realizing what dangerous enemies many of them are. The Oyster-shell Bark-louse (*Lepidosaphes ulmi*) was the species most commonly sent in; its range extends all over the province and its injuries are so apparent that they cannot escape the notice of the most careless owners of orchards. Twigs completely encrusted with the scales were received from many correspondents, showing the severity of the attack and the failure to employ any remedy. Not only do these scale insects drain out the life of the tree through the beaks of innumerable hosts, but they at the same time so weaken the vitality of the twig or branch, and eventually the whole tree, that it readily becomes a prey to canker and fungus diseases and the onslaughts of borers which only affect the sickly and the dying. Happily the remedy is simple, cheap and easy of application—lime-wash (one pound and a half of quickly slaked lime to a gallon of water) should be applied to the trees after the leaves fall in the autumn. The spraying must be thoroughly done from the highest twig to the base of the trunk so that every portion will show up white,

A second application a week or two later or before the buds open in the spring will complete the job and clear the tree. As a matter of precaution it will be well to repeat the operation during the following year. We have found many scales destroyed by a minute parasitic insect, and in some instances a fungus growth has killed the whole colony.

The San José scale is gradually spreading from its original centres of infestation in the Niagara district and Kent and Essex counties. In the former it is extending its range westward along the lake shore country towards Hamilton, and in the latter it has been found as far east as Aylmer in the county of Elgin. This spread of the insect is entirely due to the carelessness, indifference or ignorance and perhaps indolence--of a large number of owners of fruit-trees who will not take the trouble to cut down and burn dying trees or to spray all those that are in any degree infested. The lime-sulphur wash is a complete remedy, but it must be properly made and thoroughly applied. If universally employed wherever the San José scale is to be found, it would not take many years to entirely get rid of the pest.

Several other scale insects have attracted attention, but none of them have become serious pests. There is always, however, a danger that some one or more of them may develop, if neglected, into a menace to the fruit-trees they attack. The Scurfy, Terrapin, Putnam and Forbes scales are those which have been chiefly noticed. The lime-sulphur wash, followed by kerosene emulsion when the lice are moving in early summer, will keep

these scales in check. Their presence should be looked for on Hawthorns, Mountain-ash and other trees as well as those grown in the orchard or garden.

Among other insects affecting fruit-trees that were noticeable during the past season may be mentioned the Shot-hole borer or Fruit-tree Bark-beetle (*Scolytus rugulosus*), which was somewhat abundant in the Niagara district. It especially attacked cherry-trees, on which its presence was make known by exudations of gum. This small beetle does not as a rule affect healthy trees but only those that are sickly and dying, and is often found on limbs whose vitality has been weakened by scale insects. The only available remedy is to cut off and burn all limbs that have been attacked; dying trees should be removed and all brushwood from prunings burnt.

The usual perennial insects, that are more or less abundant every year, made their presence felt this year also, such as the plum curculio, the eye-spotted bud-moth, pear-tree slug, tree cricket, rose chafer and the grape-vine flea-beetle. Fuller information regarding these insects and how to deal with them may be found in a recent bulletin by the writer on "Insects affecting Fruit-trees" issued by the Ontario Department of Agriculture.

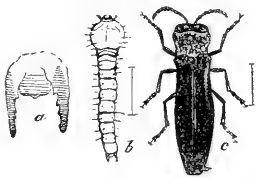

Fig. 30. Red-necked Agrillus; *a* anal processes; *b* larva; *c* beetle—much enlarged.

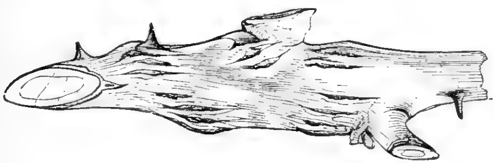

Fig. 31. Raspberry Gouty-gall caused by the Red-necked Agrilus.

Market gardeners in the neighborhood of London complained very much of an attack upon their raspberry bushes, which proved to have been made by a small beetle, the Red-necked Agrilus (*A ruficollis*). Fig. 30*c*. Portions of the canes were found to be much swollen in the form of a roughened pithy gall which rendered them liable to break off, or to dry up and die. Fig. 31. The beetle, which is about two-fifths of an inch in length, is slender in shape with a dark bronzy head, a bright coppery thorax and dark brownish wing covers. It lays its eggs on the canes in July and the grubs, which soon hatch out, burrow into the wood and by the irritation they produce in the plant-tissue cause the enlargement referred to, which is called the Raspberry Gouty-gall. The grubs are slender and thread-like, with a flat head, Fig. 30*b*, and live in the canes till the following spring, when they change to the chrysalis stage and later on appear as beetles. Cutting out and burning all affected canes is the only available remedy.

Insects of the Field and Garden.

With the exception of the outbreak of the Variegated Cutworm, elsewhere referred to, which bored holes in green tomatoes and destroyed many kinds of vegetables and flowers, there is little to report this year concerning garden insects. The tarnished and four-lined bugs, the asparagus beetles, the cucumber beetles and the turnip and onion maggots, described in last year's report, were to be found almost everywhere, but in greatly reduced numbers on the whole. Apart from Cutworms, there were few complaints from correspondents respecting our usual enemies.

Numerous requests were made for remedies against wire-worms and white-grubs. Unfortunately there is no practicable method of dealing with these underground root-feeders by poisons of any kind. The only remedy is a system of rotation of crops, by which the pastures are broken up and land is not left for a number of years in sod. Deep ploughing in the autumn brings the grubs to the surface and breaks up the pupal cells in which they are transforming to beetles; by this means the exposure to the weather and to the attacks of their natural enemies, such as birds, etc., will get rid of large numbers of them.

Owing to the unusually dry summer grasshoppers throve and multiplied to such an extent that they became a veritable plague in some localities, and inflicted a large amount of damage to oat crops, grass lands, etc. The breaking up of their breeding places by ploughing up old dry pastures and stubble fields where they have laid their eggs is a useful method for the reduction of next year's brood. When the insects are abundant in August, much may be done to get rid of them by using what is called the "Criddle mixture." This is made by taking half a barrel of fresh horse manure and mixing with it two pounds of salt dissolved in half a pail of water and one pound of Paris green. The whole should be well stirred up and then scattered by means of a trowel or piece of shingle wherever the grasshoppers are to be seen, the insects will devour this in preference to any other kind of food and be poisoned in large numbers.

Plant-lice (*Aphis*) of various kinds were excessively abundant this year, especially during the latter part of the summer and early autumn, the dry season having been favorable for their multiplication. The most serious attacks were made upon turnips and cabbages during the month of September, when complaints and enquiries came in from many parts of the province. The standard remedies for these minute insects are the contact poisons, viz., kerosene emulsion, whale-oil soap and tobacco washes. After the crop has been removed the loose leaves and stalks of the cabbages and the tops of the turnips should be taken away and the ground ploughed up; this is done to destroy the eggs, which are laid on stalks and foliage before winter sets in.

Some alarm was caused in various quarters by the newspaper reports of "the Green Bug," which was said to be inflicting enormous damage upon the wheat and oat crops in the southern and middle western States. By this name was meant a green plant-louse (*Aphis*), which is sometimes troublesome to us in Ontario. As a general rule, however, it is kept in check by its natural enemies, the lady-bird beetles and other predaceous and parasitic insects. Occasionally these are insufficient to control the pest and it becomes so abundant that it causes a vast amount of damage to the crops. This seems to have been the case in the regions referred to.

The oat crop this year was affected by a serious blight which was manifested by the leaves turning yellow and withering away. Many farmers thought that this was caused by "the Green Bug" and sent in specimens for examination. A few were found to be infested with a plant-louse (*Aphis*),

which sucks out the sap of the plant and greatly reduces its vitality; in these cases the blight might be caused by the insects' attack. But in the majority of examples which we have received and examined there was no trace of any injury by insects nor of any fungus disease. Specimens examined at the Bacteriological laboratory were also found to be free from any disease of a bacterial character. The conclusion was therefore arrived at that the blight was due almost entirely to atmospheric conditions, namely, late frosts in some localities, and in others cold, almost frosty, nights succeeded by bright, sunny days. The very late season evidently contributed to the injury, as the crop generally did not possess the vigor and vitality which would enable it to withstand the effects of occasional unfavorable weather.

REMARKABLE OUTBREAK OF THE VARIEGATED CUTWORM.

By C. J. S. Bethune, Ontario Agricultural College, Guelph.

On the evening of the 25th of July, a telephone message from Leamington was received at the Ontario Agricultural College urgently asking for help against a worm that was devouring everything before it. As no information was supplied that gave any clue to the identity of the depredator, an arrangement was at once made by the Department of Entomology to send to Leamington Mr. Cæsar, a fourth year student, and Mr. McMeans who is in charge of the vegetable gardens. They left the next morning and on the following evening Mr. McMeans brought me back specimens, which proved to be the Variegated Cutworm (*Peridroma saucia*), and gave me an account of the ravages of the insect and the advice that was given to the farmers whose crops

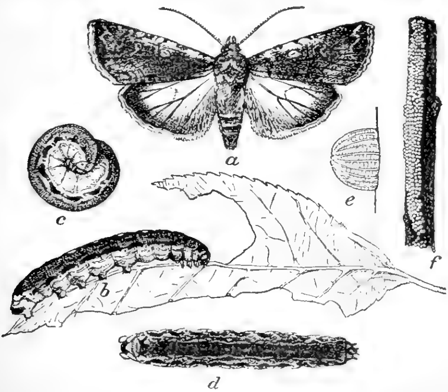

Fig. 32. *Peridroma Saucia* ; *a*, moth ; *b*, normal form of larva, lateral view ; *c*, same in curved position ; *d*, dark form, dorsal view ; *e*, egg from side ; *f*, egg mass on twig (after Howard, Division of Entomology, U. S. Dept. Agriculture).

were being attacked. Mr. Cæsar, who remained longer, subsequently gave me the more detailed report which is appended hereto. The outbreak is very remarkable, as nothing similar has been recorded since the year 1900, when these cutworms appeared in enormous numbers in British Columbia and the neighboring Pacific Coast States and were unusually abundant in

Manitoba, Ontario, and many of the States to the south-west of us. Dr. Fletcher, in his annual report for 1900 (pages 215 to 227), gives a very full account of the insect and its ravages in British Columbia during that year.

Near Leamington the worms were first observed in clover fields, where they soon devoured the crop and left the ground bare and black; they then marched on to the next field and consumed whatever vegetation they met with; corn and tobacco, tomatoes and other vegetables seemed especial favorites for consumption. If a fruit tree happened to be in their way, they climbed it and devoured both fruit and foliage; many peach trees were thus attacked and the fruit ruined.

Like other cutworms these caterpillars feed only at night and remain in concealment during the day, hiding in the ground where the soil is loose, and under any rubbish or other shelter that they can find. When full-grown the worm is about two inches long, with a yellowish stripe on each side above the legs, the rest of the body is darker and mottled with black, white or grey; the most characteristic feature is a row of yellow or white spots, five to seven in number, along the middle line of the back. Fig. 32. Some of the worms changed into the chrysalis stage early in August, others later; for this purpose they buried themselves in the ground and formed there an oval earthen cell. The moth, into which they finally turned, has a wing expansion of about an inch, and is dark blackish brown in color, often clouded with red towards the front margin of the wings, but with no conspicuous or distinguishing markings; the underwings are white with a pearly lustre. Like so many other of our most destructive insects, this one has come to us from Europe.

REPORT BY MR. L. CÆSAR TO C. J. S. BETHUNE, PROFESSOR OF ENTOMOLOGY.

SIR,—I have the honor to submit the following report of my trip to Leamington, July 26th to 29th, to aid the farmers in their struggle against an insect pest that seemed to be devouring everything before it.

I arrived at Leamington about sunset, July 26th, and at once set out for the farm of W. T. Moore, who was the first to propose sending to your department for aid. By the assistance of a lantern we were able to see the caterpillars at work on Mr. Moore's tobacco and tomatoes. They proved to be the Variegated Cutworm (*Peridroma saucia*) and were very numerous, Mr. Moore on one occasion counted as many as 250 on a single plant. They had begun their ravages in a small plot of second growth clover which he was keeping for seed. To check them Mr. Moore at once plowed this down and rolled it, thereby no doubt destroying countless numbers; but many still remained. Finally, in his efforts to keep them from destroying his tobacco and tomatoes he had hit upon the device of plowing a furrow ahead of them. This, in a very sandy soil like his, gave excellent results and impeded the progress of the caterpillars better than one would have thought possible, especially as they climb corn stalks and trees without difficulty. The fine grains of sand, however, yielding as they tried to climb, made an insuperable barrier in most cases. I recommended Mr. Moore to make holes with steep edges and about one foot deep at intervals of about every twenty feet in the furrows. Next morning I had a chance to see the work of the furrow and holes combined on an adjoining farm. The result was most gratifying to all of us. In every hole there was a mass of caterpillars an inch or more deep. The farmer went from hole to hole with a piece of fence rail about five feet long and pounded his foes in each hole to death, evidently taking much pleasure in the operation.

Though I saw that very few caterpillars had been able to escape from the furrow and holes, yet as an extra precaution I advised that the uninjured plants immediately in front be sprayed with a strong mixture of Paris green and water, or that poisoned bran be scattered among them. Mr. McMeans of the Horticultural department, who was with me, suggested shorts as an alternative for bran.

After arranging to come back in the afternoon and superintend the preparation of the poisoned bran or shorts, I was driven by Mr. Moore to several other farms which were reported to be attacked by the same pest. Of these one belonged to Mr. Quick. This gentleman, the night before I came to Leamington, had lost more than an acre of good tobacco by the attack of caterpillars. Practically nothing had been left of it. Having heard, however, of the furrow plan, he at once ploughed one and the next night was delighted to observe by the aid of his lantern that it seemed to be an effectual barrier. I mentioned a few ways in which I thought Mr. Quick could improve his furrow and also told him of poisoned bran or spraying with Paris green as further remedies. There was evidently a good deal of scepticism in his mind and in the minds of some other farmers as to the efficacy of Paris green in any shape or form. Probably this was because they did not see dead caterpillars lying on the plants or on the ground where they had tried spraying. They could scarcely be expected to think of their having buried themselves and died in the ground. However, I told them to come down and see how the experiment with the poisoned bran resulted at Mr. Moore's.

The next farm visited belonged to Mr. Copeland. Here I saw the most discouraging sight I had witnessed anywhere in the district. From several acres of clover the caterpillars had spread out in a single night and attacked in enormous numbers about two acres of beautiful corn and ruined it. Not only had they attacked the leaves but they had eaten through and through the stalks themselves. In addition to the corn they had attacked two rows of peach trees that were about three years old. If one of these trees were given a quick shake numerous caterpillars would fall from their hiding place among the foliage to the ground. Here again Mr. Copeland, having heard of the furrow and holes had resorted to this device to save the rest of his crop. It was interesting to see the host of caterpillars in the large holes he had made. So strongly did he trust to his furrow and holes that he was leaving to sun to do the work of destroying the caterpillars for him. Practically none seemed to be escaping, but I advised their immediate destruction in whatever way he wished, whether by boiling water, by kerosene, or by pounding with a stick as his neighbor had done.

Several more farms were visited and the best remedies I knew of explained to the farmers, many of whom had no idea of what they ought to do.

On my return to Mr. Moore's in the afternoon I helped him to make up what little bran he had into a poisoned mixture. The method I employed was to sweeten some water with black-strap, then moisten the bran with it and add the Paris green little by little to the moistened bran, mixing it thoroughly. I believe that a better and easier way would have been to make a paste of the Paris green with a little water and then add this gradually to the moistened bran and mix thoroughly. The trouble with the former method was that in spite of every precaution the Paris green tended to form flakes and could with difficulty be got to mix up finely with the bran. It was impossible, however, to get any more bran or shorts in the town, so we used flour and Paris green, mixing them dry. This was put on by means of a Planet Junior hand-drill, a very convenient method. Mr. Moore pro-

mised to observe by lantern light the results of our experiments with the bran and flour mixtures respectively. So after watching some spraying of hedges around a clover field, I returned to the town.

Late that night Mr. Moore met me in town and seemed very much pleased with the experiments. He reported the poisoned flour a decided success. He had less to say about the poisoned bran.

Illness during Sunday, July 28th, prevented my visiting any of the operations which I heard were going on all that day. A few farmers, however, met me and made enquiries how to fight the pest. At the request of several of the most intelligent farmers, I arranged early Monday morning for the publication and distribution of 1,000 leaflets giving instructions how to combat the caterpillars. Having seen to this and visited two infested farms where I saw that the foe was still under control I felt compelled by continued illness to return to Guelph at once.

It may be of interest to note that on at least two farms large flocks of cowbirds were seen feeding upon the caterpillars. I looked for signs of Tachina flies and other parasites, but saw none attacking the caterpillars; these were, however, great numbers of cocoons of Braconids to be found on the clover leaves. I brought some of these home and reared several adults from them.

Respectfully submitted,

L. Cæsar.

TWO-WINGED FLIES.

By Rev. Thos. W. Fyles, D.C.L., F.L.S., Levis, Que.

Two-winged flies seem to be everywhere in evidence. They are met with as far north as man has made his abode; and they abound in tropical regions. In light or darkness, be the weather fair or foul, in early Spring and late Autumn—aye, and under favorable circumstances in Winter also—two-winged flies are to be found.

Baron Osten Sacken, in his "Catalogue of the described Diptera of North America," gives the names of no less than 4,077 species of these insects; and doubtless there are many more unnamed species, belonging to the order, that will be found as time goes on and dipterologists increase. The same distinguished naturalist groups the flies into 64 families. It may well be believed that such formidable numbers are deterrent to the study of the Diptera.

Moreover, there is, I think, a prejudice, formed in early life, against the two-winged flies. The annoyance caused by house-flies, gnats, and cattle-flies, the abominable character of the blow-fly, the accounts of the *tsetse* and other hurtful species, all tend to create an utter dislike to the Diptera that is hard to overcome. I know that as a boy I was not much impressed by the story—told as a warning—of the ill-famed and ill-starred Roman Emperor who amused himself by killing flies. Questions arose in my youthful mind as to whether, in so doing, he was not acting as a public benefactor; and I am inclined to think that many a mother who in the nursery, would tell her children not to be cruel and kill flies, would, in the kitchen, spread a sheet of "tangle-foot" without compunction.

Yes—the order Diptera is not generally regarded with favor. Nevertheless, as Mr. Macy says in *Silas Marner*, "a fly is a fly, though it may

be a hoss-fly,* and the habits of even this depreciated "hoss-fly" are so remarkable and its life-history is so strange, that, duly observed, they cannot fail to interest.

Undoubtedly many of the two-winged flies cause annoyance, both to man and beast; some are highly destructive to our food-supplies; some, on the other hand, are useful in keeping down the numbers of other insects, and others again, in consuming animal and vegetable substances that would cause harmful exhalations.

I shall endeavour to guard against wearying my readers with minute descriptions of many species. I hope to kindle an interest in the Diptera by telling of peculiarities in the structure and habits of some of the more remarkable of the kinds that have come under my notice.

The first family in Osten Sacken's list is the *Cecidomyiidæ* a very important group of insects. In it come two of the worst insect pests that have troubled the Agriculturist, viz., the Hessian Fly (Fig. 33), *Cecidomyia destructor,* Say, and the Wheat Midge, *Diplosis tritici,* Kirby (Figs. 34 and 35).

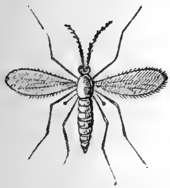

Fig. 33.—Hessian Fly —greatly magnified.

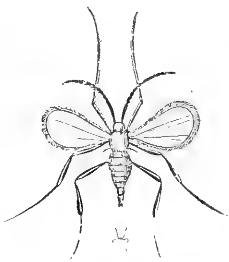

Fig. 34.—Wheat Midge—natural size shewn below.

Fig. 35.—Wheat Kernel attacked by Midge.

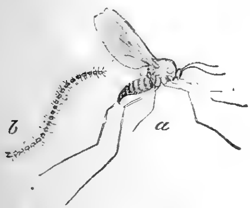

Fig. 36.—Willow-gall Midge—*a* the fly, much enlarged, *b* antenna highly magnified.

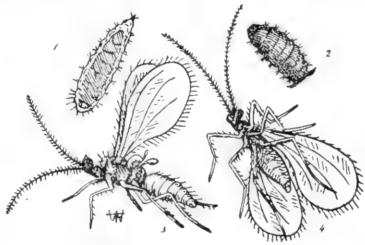

Fig. 37.—Diplosis grassator—1 larva, 2 pupa, 3 fly, side view, 4 fly, under side (original).

Of *C. destructor,* two broods appear in the year—one in May, the other in September. Each female fly lays about 30 eggs, on the blades of wheat, or of some other kind of grass. The eggs are minute, cylindrical, red points.

*"And you're a doctor, I reckon, though you're only a cow-doctor—for a fly's a fly, though it may be a hoss-fly," concluded Mr. Macey, wondering a little at his own "cuteness."—*Silas Marner,* ch. VII

They hatch in a week if the weather is warm; and the little white maggots work their way down between the leaf and the stem of the plant, till they come to a joint; there they commence to drain away the juices of the plant. About the first of June, the maggots go into what is called the "Flaxseed stage," because of the shape and color of the pupa case, or "puparium." The perfect insects appear in August, and lay their eggs for the second brood. Where Fall Wheat is grown it should not be sown till September; and Spring Wheat should not be sown till the end of May.

Diplosis tritici became very destructive in Lower Canada in 1834. In 1856 it was estimated that the loss on wheat in Canada, occasioned by the Midge was $2,500,000. The perfect insect is a minute, orange-colored fly, with black eyes, yellow legs, and wings that resemble thin films of mica. It makes its appearance when the wheat is in flower; and the female lays her eggs in the floret—the harm done by this insect is directly to the kernel (Fig. 35). The maggots get their growth in three weeks, and then wriggle to the ground and bury themselves, remaining unchanged through the Winter, and going into pupa in the Spring. The flies come forth in the end of June. Because of the damage done by this insect, and because Western flour can be bought so cheaply, our farmers in Quebec Province have, very generally, abandoned the growth of wheat.

A very interesting Cecidomyian is *C. strobiloides*,, Osten Sacken (Fig. 36). This fly lays an egg in the terminal bud of a shoot of sallow. The little orange-colored grub that comes from the egg so affects the bud, that it develops into a good-sized cone-shaped gall, which becomes dry and hard as the Winter advances. In the centre of this gall, and in a delicate, membraneous cocoon, the grub remains till early Spring, when it changes to a pupa. In April or May the perfect flies appear. When I was studying these creatures I opened some of the galls to watch the changes of the insect, and, as I thought, to aid the prisoner to escape, but the interference did harm; the fly from the open gall was always defective—as we say "crippled." It seemed as if the effort on the part of the insect to work its way upward, was absolutely necessary to the attainment of its higher life. And in this we have one of Nature's many parables.

A fly of great economic importance is *Diplosis grassator*, Fyles (Fig. 37), which in this country preys upon and keeps down the numbers of the dreaded *Phylloxera vastatrix*, Planchon.

The story of my discovery of this insect is as follows:

In the summer of 1882, I spent some time at Como, on the Ottawa with my friends, Mr. and Mrs. I. J. Gibb. Growing over the fences of the highway which ran through their estate, and extending for many yards, were several native vines. They were badly infested with *Phylloxera vastatrix*. As this pest was then exciting much attention, I was pleased with the opportunity of studying its habits. I soon found that at this place it was assailed by a formidable foe, an orange-colored dipterous larva. The business-like way in which this creature gave the *quietus* to the larva of the Phylloxera aroused my curiosity, and I resolved to study the species carefully. Accordingly I took a mass of the affected foliage home to Cowansville, where I then resided, and arranged for fresh supplies, properly secured, to be sent to me by post. At home I spent much time at the microscope, observing the structure, habits, and metamorphoses of the species; and I made, with the utmost care, drawings of it in its larval, pupal, and imago stages.

The Annual Meeting of the Entomological Society of Ontario was held that year in Montreal, and was attended by a number of scientists from the

United States. Among them were Professors Lintner, Hagen, and Riley. I brought the insect under the notice of the meeting. No one present professed an acquaintance with it, except Dr. Wm. Saunders (see 13th An. Rep. Ent. Soc. of Ont. p. 10); but Dr. Riley, from the description given, and the specimens shewn, pronounced it to be a species of Diplosis.

I then wrote to Dr. Williston, sending him particulars, and asking him for information He very kindly replied, furnishing me with references to a number of species of Cecidomyia, and adding:

"It is probable that your species is not one of these, but new. Still I should examine the subject as far as possible. At all events its life's history is interesting, and worthy of immediate publication. *L. vitis* is the only species in which the imago and complete life history are known."

Acting upon Dr. Williston's suggestion, I sent the life-history of the insect, with illustrations to the "Canadian Entomologist."

They appeared in the December number of the magazine (Can. Ent. Vol. XIV, p. 237), together with a confirmatory statement from Dr. Saunders, the editor. The number was printed January 10th, 1883.

On the 27th of February, 1883, I received a kind letter from Dr. Hagen, who said, with reference to *D. grassator*—specimens of which I had sent him: "The fly is, I think, a Cecidomyia. I think it is not sure that it belongs to Diplosis. At least the reticulations of the wing differ in having the median veins straight, and the fork at the hind margin wanting. You will see in Osten Sacken's Catalogue, that the museums do not possess this type for Cecidomyia. I have gone through the literature, and find, till now, that your species is not described."

D. grassator is not a gall-producer like certain Cecidomyians spoken of by Walsh and Riley.

Its larvæ do not extract sap from galls as do those of *C. albovittata*, Walsh.

They do not feed on fungi, like those of *D. coniophago*, Winnertz.

They have not horny hooks at the tip of the abdomen like those of *C. populi*, Duf.

They are not white, like those of *D. caryæ*, O.S.

They do not go under ground to pupate like those of *Lasioptera vitis*, O.S.

The pupa has not two oblique processes from the anal end, like that of the *Lucopis* mentioned by Riley.

The imago has not violet-blue spots, nor are tibiæ and tarsi annulated with black, as in *D. maccus*, Lœw.

It is not brownish-black with white hairs like that of *C. (Diplosis) Pini*, De Geer.

Its thorax is not blackish above with a golden pubescence as in *Lasioptera vitis*, O.S.

I think I may say with all confidence, that my account of the insect, with the notes of Drs. Hagen and Saunders, and the illustrations given afford sufficient specific distinction for the recognition of the insect.

If *D. grassator* had been carried to France with the American vines introduced by the Duchess of Fitzjames, the loss to the Gironde, amounting to \$100,000,000, might have been lessened, and the vineyards ultimately saved.

In the next family, the *Pulicidæ*, Packard and others have placed the Fleas. These creatures, though they have no wings, are shown by the form and habits of their larvæ, to be rightly placed. Of their many species *two* are very well known—*Pulex irritans*, Linneus, the Human Flea, and *Ceratopsyllus serraticeps*, Gervais, the Cat and Dog Flea (Fig. 38).

About fifty years ago an ingenious Italian (said to have belonged to a good family in his own land), was employed by Sir Edmund Head, as steward, and afterwards in the same capacity by the Stadacona Club of Quebec. Bertolotto—for that was his name—observing the structure of the flea, its great strength, and its rigid, protective armor, conceived the idea of harnessing the insect, and turning it to account for the amusement of himself and his friends.

And here I would say that I am indebted for most of the information that I can give, respecting Bertolotto and his Fleas, to D. Jewell, Esq., broker, who was intimately acquainted with Bertolotto, Lt. Col. Gray of H. M. Customs, who was a member of the Stadacona Club during the time of Bertolotto's stewardship, and the Rev. E. A. W. King, M.A., Rector of St. Peter's, who witnessed one of Bertolotto's exhibitions in Boston, Mass., at the time of the American Centennial (1876). These gentlemen are all living in Quebec.

Bertolotto broke his fleas of the habit of jumping, by confining them in a glass tube about half an inch in diameter. He fastened a silken tie around the waist of each; by means of this he could attach them to various contrivances. He made a small carriage, fastened fleas inside as passengers, a flea on the box as coachman, and a flea behind as footman or guard. Then fastened fleas to the pole as horses. These soon found that "a long pull, a strong pull, and a pull all together," was the way to advance; and so the equipage moved on, to the delight of the observers. A number of like contrivances made up a show, that from its very novelty, became popular, and consequently remunerative; and Bertolotto travelled to exhibit it.

I have been told that, on a certain occasion, when giving a parlour entertainment, before some exalted personages, Bertolotto discovered, to his dismay, that his leading performer, his best trained flea, which he had named Napoleon, had made its escape. In the warmth of his southern temperament he bewailed his loss –"Oh, my Napoleon! My Napoleon is gone! What shall I do?"

As the escape of Napoleon the Great from Elba occasioned dismay amongst the powers of Europe, so the escape of Napoleon the Little occasioned disturbance in the minds of the ladies present—they anticipated dire attacks.

Presently one of the fair ones hastily left the room. Soon afterwards a maid came in, bearing a plate, and on the plate a glass, and under the glass *a flea*. Bertolotto welcomed it with delight. But telling the story afterwards he said, "Lo and behold, *it was not my Napoleon at all!*"

The Rev. Mr. King thus described the performance he witnessed:— "Bertolotto stood behind a counter, and had a sheet of glass before him. His visitors were seated round the room. Three or four persons came up to the counter at a time. Bertolotto first exhibited a small house, that he called the "Fleas' Hotel"—he had about 50 fleas in it. Then *an uneducated flea*, fastened by a fine gold chain to a small ball, was shown. This flea jumped about wildly. After that a Flea Orchestra was exhibited; about twenty-five fleas, each bearing a minute imitation musical instrument, were placed in a semicircle, and went through the motions of playing upon their instruments, while a musical box gave forth a tune. The Prince of Wales in India was represented; a toy elephant bearing a howdah was set out; fleas represented the prince and his attendants, and a flea was the mahout. A Military Review; the Coach and Horses; a Flea working a windlass that brought up a small bucket, etc., etc., were shown."

Questioned about the feeding of his fleas, Bertolotto said that he fed them only at night; and he showed a red place on his wrist—a token of the *phle*-botomy he had undergone the night before.

When he was asked, "Where do you get your fleas?" he replied, "Not in Massachusetts; the fleas here are too poor—they are no good. *I have to send to Canada for the good ones!*"

Mr. Jewell has given me an original ticket for Bertolotto's show. It reads:—

"Signor Bertolotto's
original exhibition
of the
EDUCATED FLEAS
Now open at 39 Union Square,
From 10 a.m. to 6 p.m.
Admission 25c
Programmes in the Exhibition Rooms."

Between the words *original* and *exhibition* there is a small engraving of a flea with a soldier on its back.

The family Simulidæ is an objectionable one.

I lived many years ago in a cottage near a brook, which meandered through a valley, and fell into a neighboring lake. This brook abounded with the pretty little trout, *Salmo fontinalis*......It also abounded with the larvæ of the Black Fly of the North, *Simulium molestum*, Walker, which are said to be harmful to the young fry of the fish.

The Black Fly itself is a compact insect having a stout proboscis with which it inflicts a more severe wound than that given by the mosquito. I have seen the faces and necks of children running with blood from the bites of this insect.

There is a stately White Willow over-shadowing my yard at Levis, and other trees are near. In the calm summer evenings, when the light has been fading, I have often sat upon my verandah and watched the mazy dance of *Plecia heteroptera*, Say, plainly seen against the western after-glow. This insect is a *black* fly—entirely black; but it is "guileless of offence." It belongs to the family Bibionidæ.

The disreputable family of mosquitoes known as the Culicidæ have been ably set before us by Howard, Smith and other writers. Our common species at Quebec is *Culex consobrinus*, Robineau-Desvoidy.

Drain the land, stock the pond with fish, keep the water-butts closely covered, banish the mosquitoes—"their room is better than their company."

A very interesting family of two-winged flies is that of the Tipulidæ. The typical insect of this is the Tipula, Crane-fly, or Daddy-long-legs.

The finest of our Quebec Tipulidæ is *Tipula flavicans*, Fab. It has an expanse of wings of nearly two and a half inches; and its legs when extended reach over a space of three and a half inches diameter. The wings of this insect are prettily veined and are spotted with brown and white. Its long abdomen is light with dark brown markings.

A very pretty Crane-fly is *T. trivittata*, Say. It has three smoky brown bands crossing the wings, and the wing tips are clouded with the same color.

A very common insect in our woods is *T. cincta*, Lœw. It is very Quaker-like in its coloring, having body, legs and wings of a sober drab.

Smaller and brighter in color is *T. ferruginea*, Fab. Its prevailing color is orange-red.

Pedicia albivitta, Walker, is a larger and handsome Crane-fly. It may be readily distinguished by its brown costa and the obtuse-angled triangle raised upon it. In the male of the species there is a brown line running from the obtuse angle to the hind margin of the wing.

In June, 1896, I took, in the grounds of my friend Mr. Wheeler, at Bergerville, a fine species of *Ctenophora*. Its head and thorax are jet black, polished; its abdomen is black, excepting the two first segments which are

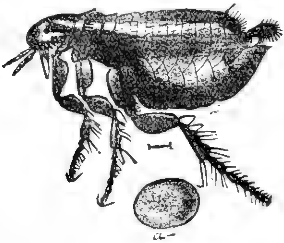

Fig. 38. Cat and Dog Flea, greatly magnified; *a* the egg.

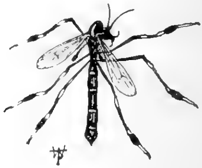

Fig. 39. *Bittacomorpha Claripes*. (original).

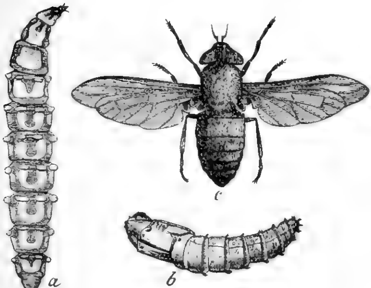

Fig 40. Black Horse Fly; *Tabanus atratus*.

Fig. 41. Robber Fly; *Asilus*.

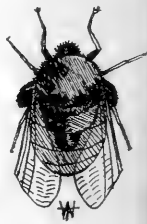

Fig. 42. *Pterodontia flavipes* (original).

Fig. 43. Syrphus Fly.

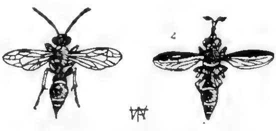

Fig. 44. 1. *Odynerus tigres*. 2. *Temnostoma bombilans* (original).

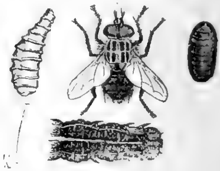

Fig. 45. Tachina Fly, parasite of the Army-worm.

bright red. The legs are red. The wings are somewhat smoky; their veins are dark brown distinctly marked, and there is a brown spot on the costa at about one-third the length of the wing, counting from the tip.

But I think the most remarkable of the near relatives of the Tipulidæ is *Bittacomorpha clavipes*, Fabricius (Fig. 39). This creature has trans-

parent wings, a thin body, and long legs banded with white. When it flies you do not see its wings—it seems to float like a film. It is an insect fairy.

One female Crane-fly will lay about 300 eggs. These are small, black and glossy. They are laid in, or close to, the ground. The grubs that come from them are familiarly known as Leather-jackets. They feed on the roots of grasses, corn, etc., and sometimes do much damage. Unlike other maggots the larva of the Crane-fly has a well-marked head, black and horny, with a pair of strong black jaws; and a pair of small horns. At the blunt extremity of the creature are four tubercles. The grubs turn to pupæ in the ground; and the flies appear towards the end of summer.

Fall ploughing, rotation of crops, lime-dressing for the land, drainage, all help to keep the numbers of the Leather-jackets down.

The perfect flies are quite harmless. They are remarkable for the seeming ease with which they part with their limbs. I find it rather a difficult matter to obtain perfect cabinet specimens of them.

In the Cœnomyiidæ comes the *Cœnomyia pallida* of Say. This fly is figured by Gosse in the *Canadian Naturalist* p. 199. It is believed to be the same as the *C. ferruginea* of Europe. I have four fine specimens in my collection. They were taken in the Eastern Townships, at different times. The fly is fawn-colored throughout, with large blue-black eyes.

The family Stratiomyidæ numbers some fine insects. One of them is quite common at Quebec, viz., *Stratiomyia obesa*, Lœw. It has a yellow face jet black eyes, a black body marked with yellow stripes; its legs are yellow, and its wings are light fawn-colored, darker on the fore part of the wing. It is a handsome fly.

A family of objectionable insects is the Tabanidæ. Amongst them comes that annoying fly, *Chrysops fugax*, Walker, which does its worst to spoil the entomologist's pleasure in the woods and fields, especially when there are cattle near. This fly is black, and has a brown patch in the centre of the wing. There is no mistaking it—its incessant audacious attacks make it known.

Happily we have not in Quebec the formidable *Tabanus atratus*, Fab. (Fig. 40). But the fine fly *Tabanus rufus*, Palisot Beauvois, often made its appearance round my stable when I kept a horse and cows. It is three-quarters of an inch in length of body, and an inch and a half in expanse of wings. Its prevailing color is brick-red.

To the Asilidæ belong the Robber Flies (Fig. 41), which are so named from their habit of pouncing down upon the backs of other insects and destroying them.

I have seen the King Bird alight, with the utmost daring and dexterity, upon the shoulders of the Hen Hawk, and peck at its head to drive it away from the neighborhood in which the little King Birds were gathered. And the Robber Flies do not hesitate to pounce down upon such formidable insects as wasps and bees—not merely to put them to flight, but to drain away their life-juices. Our commonest kind is *Asilus Novæ-Scotiæ*, Macquart.

The Bombylidæ are an interesting family. From their habit of hovering over blossoms, they are called Bee Flies. *Anthrax fulviana*, Say, is quite common at Quebec. Its brown body is covered with a yellow down, and its wings have an irregular brown border along the costa. A less bulky and prettier fly is *Anthrax sinuosa*, Wiedemann. This is dark brown in color, and its wings are of a rich warm brown, but have a clear space along the hind margin. In the genus *Bombylius* we have *fratellus*, Weid., *major*, Linne, and *pygmæus*, Fabricius. The last named is a veritable fairy. Its small brown body is edged with yellow; its wings are richly

spotted with black, and have a brown bar along the costa; and its proboscis extends in a straight line from the head—as is the case also with *fratellus* and *major*.

Of the Leptidæ I have taken *Leptis Boscii*, Macquart, at Quebec; of the Empidæ, *Rhamphomyia umbrosa*, Lœw.; and of the Therevidæ, *Thereva senex*, Walker.

A fly of strange appearance is *Pterodontia flavipes*, Gray (Fig. 42). It is oval in shape and raised, and looks like a large Lady-bird. Its colors are black and red. It comes in the family Cyrtidæ. I have taken a few specimens of this fly at the Gomin Swamp.

The family Syrphidæ contains a number of remarkable flies. Some of them have a strange resemblance to wasps (Fig. 43). One day when seeking in the woods for additions to my collections of the Vespidæ, I saw what I took to be a fine female of *V. arenaria*. I caught it and found that it was a specimen of the Syrphid, *Spilomyia fusca*, Lœw.

Milesia eccentrica, Harris, resembles a yellow wasp, and so in less degree, does *Chrysotoxum derivatum*, Walker.

Temnostoma bombylans is a handsome fly belonging to the Syrphidæ. I do not know its history; but the creature bears so striking a resemblance to *Odynerus tigres*, that I suspect it to be a familiar of that wasp (Fig. 44).

Sericomyia militaris, Walker, is quite common at Quebec. It probably derives its name from the yellow bands on its abdomen, which look like the facings of a soldier's coat.

Spilomyia quadrifasciatus, Say, is a large, handsome fly. Its long, cylindrical abdomen has a conspicuous golden band round the upper part.

The rat-tailed maggots of *Eristalis tenax*, Linneus, thrive in polluted water. The tail is a breathing-tube. The flies of the species may easily be mistaken for drones of the Hive Bees, and are commonly called Drone Flies. Besides this species, *E. transversus*, Wied., and *E. dimidiatus*, Wied., are common at Quebec.

Volucella erecta, Walk., is very common with us. Its Larvæ are found in Bumble Bees' nests.

I have taken three specimens of the pretty fly *Conops furcillatus* upon flower-heads. The larvæ of the Conopidæ are said to be parasitic in the bodies of Bumble Bees.*

In the Œstridæ we find the Bot-flies of the horse, ox, sheep, etc. The Horse Bot-fly, *Gastrophilus equi*, Meigen, lays its eggs on the fore-legs of the horse. The larva, leaving the egg, causes irritation and is licked off by the horse. It is carried in the saliva to the stomach of the animal. There it attaches itself, and from thence on getting its growth, it is voided.

The larvæ of the Ox Bot-fly or "Warble-fly," *Hypoderma bovis*, Fab., cause tumors in the back of the ox, which injure the skin—a grubby hide is of one-third less value than a sound one.

The Sheep Bot-fly, *Œstrus ovis*, Lin., lays living maggots in the nostrils of the sheep. These crawl into the frontal hollows of the sheep's head, and get their growth there.

The family Tachinidæ is a large one, Fig. 45. In it we have *Histricia virida*, Harris, a showy bustling insect, with a rounded, red abdomen, set with black bristles. It is common and well known.

*"The Conopians undergo their transformations in the bodies of humble bees, their young subsisting on the fat contained within the abdomen of their luckless victims."—Harris, "Insects Injurious to Vegetation," p. 611.

Another fine insect in the same family is *Echinomyia florum*, Walker. It is of a glossy blue-black, with light sienna-colored wings, and has a yellow patch on either side of the first joint of the abdomen.

Gonia capitata, DeGeer, is a prettily banded fly, also in the Tachinidæ. It frequents flower-heads, and was abundant at Quebec two years ago.

A fly of strange habits is *Sarcophaga sarraceniæ*, Riley, Fig. 46, belonging to the family Sarcophagidæ. In the pitchers of the plant, *Sarracenia purpurea*, will be found a decaying mass of insects, which had been attracted by, and drowned in, the liquid that the pitchers contain. Into this corrupting mass the fly, *S. sarraceniæ* drops her eggs. The maggots from these thrive in pollution and, after attaining their growth, bite a way through the side of the pitcher and fall into the surrounding herbage, in which they undergo the pupal change.

The Muscidæ form another large family, Fig. 47. In it we find *Musca domestica*, Linn., *Lucilia Cæsar*, Linn., *Sarcophaga carnaria*, Linn., household pests too well known.

In the Anthomyidæ comes the troublesome *Anthomyia raphani*, Harris, which spoils our radishes.

The ochre-colored Dung-fly, *Scatophaga stercoraria*, Linn., is common. It is a representative of the Cordyluridæ.

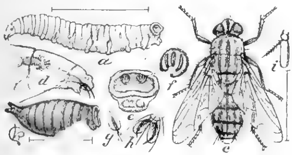

Fig. 46.—Sarcophaga sarraceniæ.

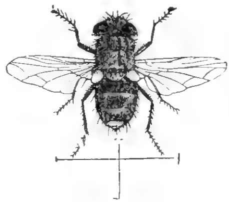

Fig. 47.—A Muscid Fly.

Among the Ortalidæ is found that most remarkable and handsome fly, *Pergata undata*, Wied., which is figured on page 610 of "Insects Injurious to Vegetation" by Harris. I have taken several specimens of this fine fly in the Eastern Townships.

Another beautiful insect belonging to this family is *Chætopsis ænea*, Wied. It has a glossy blue body, and pretty banded wings. I have found its maggots preying upon Lepidopterous larvæ, in the stems of bulrushes, and have raised the perfect insects from them.

Of insects in the family Trypetidæ I have taken at Quebec, *Straussia longipennis*, Wied., *Eutreta sparsa*, Wied., *Eurosta solidaginis*, Fitch, and *Tephritis albiceps*, Lœw.

It is *Eurosta solidaginis* that inhabits the large, round pithy galls that are found on the Golden Rod.

In the Piophilidæ comes the well known *Piophila casei*, Linn., whose larvæ are the "hoppers" found in cheese.

There are some other families of Diptera to which it does not come within my present purpose to refer. I have endeavored to compress within the limits of this article such information as seemed to me likely to arouse an interest in the two winged flies, and to convey ideas of their number, variety and habits. Every species has doubtless its peculiar life-history —known or unknown, to man. Every species fulfils its purpose in the economy of Nature. They all bear testimony to the marvellous resources of the Divine Creator, who *in Wisdom hath made them all.*

SUMMER MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

A summer meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, July 4 and 5, 1907. Through the kindness of President Creelman the members from a distance were hospitably entertained in the College residence during their visit, the ladies of the party being provided for in the Macdonald Hall. The number in attendance was smaller than anticipated, many who had been looking forward to taking part in the meeting being prevented from coming by a variety of causes. A very satisfactory audience, however, was made up by the Summer School of Ontario teachers from the Macdonald Institute, and several students and members of the College staff. The sessions began on Thursday afternoon in the lecture-room of the Biological Department, the President of the Society, Dr. Fletcher of Ottawa, being in the chair. Mr. H. H. Lyman, of Montreal, read a paper on the distinctions between *Thecla calanus* and *Edwardsii*.

Dr. Brodie, of Toronto, described the life-history of a colony of the Tent Caterpillar and related his experiences in breeding a large number during a series of years in order to observe the effects of parasites upon them.

Dr. Fletcher gave an account of a visit he recently paid to Massachusetts and described what was being done to control the Brown-tail and Gypsy moths by the importation of parasites from Europe and by practical field operations.

Mr. C. W. Nash, of Toronto, spoke on "Balance in Nature," in which he described in a very interesting manner some of the numerous checks and counter-checks which are provided in order to prevent the undue preponderance or the extermination of any particular species, and showed how this balance had been upset by man's disturbing agency and the difficult problems that had arisen in consequence. A discussion followed which was participated in by the chairman, Dr. Brodie, Prof. Bethune, Mr. Jarvis, Mr. Cæsar and others.

In the evening the session was held in the Nature Study Lecture-room of the Macdonald Institute and was attended by the Summer School and a number of others from the town and College as well as by the members of the Society. Dr. Henry Skinner, of Philadelphia, gave a highly interesting lecture on "Insects as Carriers of Diseases." Mr. C. W. Nash followed with a lively address on "Instinct *vs.* Education" and Dr. Fletcher spoke in his usual attractive manner on "Nature Study as a Means of Education." The evening was thoroughly enjoyed by all present and no doubt the school teachers carried away with them much information and many impressions that will be of value to them in the future.

The next day, July 5th, was given up to an excursion to Puslinch Lake, a picturesque sheet of water about nine miles from the College. The Summer School joined in the picnic, making up a party of more than sixty in all. The day was spent in collecting botanical and entomological specimens and other objects of interest. At the close short addresses were given by members of the College staff and others on various specimens that had been brought in, including fresh-water shells, insects, and plants. The meeting on the whole was so delightful and successful an experiment that it will no doubt be repeated in future years and become annually more attractive and well-attended.

ENTOMOLOGICAL RECORD, 1907.

By Dr. James Fletcher and Arthur Gibson, Ottawa.

The season of 1907 in Canada will long be remembered for its unusual and irregular character. The spring, right across the continent from the Atlantic to the Pacific, was cold, dry and late. As a consequence, insects of all kinds were remarkably scarce, and the paucity of insect life in April and May had a direct effect on bird life as well as in many places also upon the fruit crops. Where fruit growers were fortunate enough to have colonies of bees near their grounds there was a conspicuous advantage to the crop from the much larger number of flowers which were fertilized by these useful agents and friends of the fruit grower. The main migration of warblers and other insect-eating birds was much delayed by cool weather and the tardy revival of insect life. The exceptionally backward nature of the season continued throughout the summer and was only in a measure compensated for by the long open autumn without killing frosts. From an entomological point of view, we seem to be passing through a period of "poor years," which began with the year 1901. Notwithstanding this, there has perhaps never been a time when better work has been done in investigating the insect fauna of the country. This is directly due to the far higher appreciation of the value of entomological studies, the greater number of workers and the improved facilities for those studying insects to get into touch with others of similar interests.

The appearance of several elementary works on various branches of the subject, such as the Insect Book, the Butterfly Book and the Moth Book, have acted as a stimulus to direct the attention of students to, and encourage them in the study of entomology. Local Natural History Societies, Horticultural Societies and schools, in all parts of the country, are devoting more time than ever before to the habits of insects, and the observations of their members are being published for the help and encouragement of others. Agricultural journals now include regularly articles upon the insect foes and friends of the farmer. The value of these articles depends entirely upon their scientific accuracy, and there is a constant demand for information on the life histories of insects. Such facts as this information is founded upon, can only be learnt by careful and close personal observation by the trained entomologist. The members of the Entomological Society of Ontario, located in all parts of the Dominion, are collecting assiduously and, in the pages of the *Canadian Entomologist* and of the Annual Reports, are making known their discoveries for the benefit of the whole country.

During the past year, in addition to the constant and important work of many collectors who have not the opportunity to travel from their own home fields of action, several collectors have penetrated to little known fields of work and have brought back many treasures, which in due time will be worked up and reported upon; thus, useful knowledge will be disseminated as to the geographical distribution of species, their life habits, and varying foods in widely separated localities. Of the officers of the Geological Survey Department, Mr. Joseph Keele, collected during the past summer along parts of the Stewart and Pelly Rivers in the far off Yukon. Mr. W. J. Wilson again visited the Hudson Bay slope and was this year along the height of land. Mr. T. P. Reilly, of the Alaska Boundary Survey, and Mr. Douglas H. Nelles, of the same Survey, brought back small collections, the former from near Sixty Mile River, along the 141st meridian in the Yukon, and the latter from Bartlett Bay, off Glacier Bay, Alaska. Mr. Andrew Halkett, Naturalist of the Department of Marine and Fisheries, collected during the last summer

in the Provinces of Saskatchewan, around the Qu'Appelle Lakes, and in Alberta around Beaver Lake. which localities he was visiting to study the local fishes, but found time to collect several interesting insects. Mr. J. B. Wallis, of Winnipeg, collected at Banff, in the Rocky Mountains, and at Peachland, in the Okanagan Valley, B.C., where he made large collections of insects during July and August. Dr. E. M. Walker, of Toronto, spent the summer at the Georgian Bay Biological Station, at Go Home Bay, Ont., where he made interesting observations on aquatic insects. He also took short trips to Nepigon and Fort William, where he made important collections of orthoptera and odonata. In the month of June, Mr. W. D. Kearfott, the well known microlepidopterist, of Montclair, N.J., paid a visit of a few days to Ottawa, where he made large collections at various places in the district. Dr. Henry Skinner, of Philadelphia, also visited Canada and, after addressing our members at the summer meeting in the beginning of July, proceeded with Dr. Fletcher to Nepigon where two days were spent. They then went to Aweme, Man., and had four days collecting with the Messrs. Criddle, after which a long trip was taken in company with Mr. T. N. Willing, along the Canadian Northern Railway; districts visited were, the Goose Lake district west of Saskatoon, Duck Lake, Prince Albert, Kinistino, Radisson, Lloydminster, Edmonton, Calgary, Banff and Laggan. From Laggan Dr. Fletcher went alone to Vancouver Island. Large numbers of insects were collected in all localities mentioned above. Mr. Gibson spent the first three weeks in September at Rostrevor, on Lake Rosseau, Muskoka, and notwithstanding the unfavorable season, collected enough insects to indicate the richness of the locality. Mrs. Nicholl, of Bridgend, South Wales, this year made a third expedition to the Rocky Mountains and British Columbia, for the special purpose of collecting butterflies. In part of her expedition she was accompanied by Mr. F. H. Wolley-Dod, and, on the whole, these trips were very successful. Mr. Dod has kindly provided us with several of Mrs. Nicholl's records in addition to his own, and there is much of the material still to be worked up.

We have again to express our great obligation to the leading specialists in the United States for their constant courtesies in naming material for our Canadian collectors. Dr. Howard, of Washington, with his assistants; Dr. J. B. Smith, of New Brunswick, N.J., Prof. H. F. Wickham, of Iowa City, Mr. W. D. Kearfott, of Montclair, N.J., and Mr. E. P. VanDuzee, of Buffalo, have placed us all under deep obligations to them. Sir George F. Hampson, of the British Museum, has not only sent several copies of his valuable catalogue to those who have contributed specimens to the British Museum, but has also corrected the names of some species which had been standing under wrong names in Canadian collections for some years.

Literature.

Among the many valuable works, reports and separate papers which have dealt with Canadian insects and which have appeared during the past year, special mention may be made of the following:

Busck, August, Revision of the American Moths of the Genus Argyresthia (separate from Proc. U. S. National Museum, Vol. XXXII., pp. 5 to 24, plate IV., V.), Washington, D.C., 1907. In this important pamphlet, Mr. Busck gives a monograph of the American species of these most attractive and beautiful little moths. All the species are figured except three doubtful species which are unknown to the author. Of particular interest to Canadian collectors are *A. conjugella* which is occasionally destructive to apples in British Columbia and *A. thuiella*, which has been noticeably injurious to the

American Arbor-vitæ, or White Cedar, of Eastern Ontario and Western Quebec, for the past three years. With Mr. Busck's excellent paper there should be no trouble in recognizing any species that have been described.

CAUDELL, Andrew Nelson, The Decticinæ (a group of Orthoptera) of North America, ninety-four figures. (Separate from Proc. U. S. National Museum, Vol. XXXII, pp. 285-410, published May 23, 1907.) An important paper and one which will be of great help to those studying Orthoptera. Mr. Caudell deals in an exhaustive way with a group which has been found very troublesome to students. His opportunities to study a large number of specimens and also of having travelled extensively in the localities where many species occur have given him facilities which few have enjoyed. The figures given are excellent and will be of great assistance to those working at these difficult insects. Several published species have been reduced to synonyms and new genera have been erected, but the work is very thorough and all orthopterists will be grateful to the author for this timely monograph.

CHITTENDEN, F. H., Sc.D., U. S. Department of Agriculture, Insects Injurious to Vegetables. Small 8vo. New York. Orange Judd Co., 262 pp., 163 illustrations. This is a handy little manual treating briefly of the best known insects which attack vegetable crops and giving the remedies usually applied. Preliminary chapters deal with the value of a knowledge of entomology, the classification of insects, practical agriculture and artificial remedies, and apparatus. Not only will this book be of use to gardeners, but it should be a convenient handbook for students and teachers.

DYAR, H. G., Report on the Mosquitoes of the Coast Region of California, with Descriptions of New Species. (Proc. U. S. Nat. Museum, Vol. XXXII, pp. 121-129). Although a paper of only a few pages, this article by Dr. Dyar will be read with much interest by our western dipterists, as it deals with many species which are found in British Columbia and some other parts of Canada. *Anopheles maculipennis* of the West is now *Anopheles occidentalis* D. & K. A majority of the species treated either have been already found in British Columbia or are sure to be discovered as more extensive collections are made. The value of securing the preparatory stages is shown in many instances in the present paper. Anyone having opportunities of rearing the larvæ of mosquitoes should be careful to save the exuviæ and forward them to Dr. Dyar with the specimens for examination, remembering always that a few perfect specimens are of far more value than a large number of broken ones.

CASEY, T. L., A Revision of the American Components of the Tenebrionid sub-family Tentyriinæ (Washington Academy of Sciences, Vol. IX, pp. 275-522). October 18, 1907. In this important work Major Casey monographs in a thorough manner and brings up to date all that is known of "that part of the great family Tenebrionidæ, having the abdominal segments unmodified by a coriaceous hind margin and the middle coxæ enclosed externally by the sterna alone, without the intervention of a small piece attached to the coxæ and sometimes separating the sterna, known as the trochantin." This was Leconte and Horn's definition of the subfamily and has been adopted tentatively for the meantime. The author suggests that he may have overstepped the limit of prevailing conservatism in proposing new genera, but the high quality of Major Casey's work during many years has prov d that although it has occasionally been somewhat severely criticised, on account of this very feature, and the great convenience and stability of a large proportion of his differentiations, these are being adopted more and more even by the most conservative. As in the case of his work on Staphylinidæ, noticed last year, much foreign material has been used in making comparison

with American forms. The advantage of this is shown in many places. We trust that Major Casey may at no very distant date treat the other subfamilies of the Tenebrionidæ in the same thorough manner as he has done in this publication.

Gillette, C. P., Chermes of Colorado Conifers (Proc. Acad. Nat. Sciences, Philadelphia) January, 1907 (separates issued April 2, 1907), pp. 22, plates 11. This article by Prof. Gillette is the most important contribution towards our knowledge of the spruce gall lice which has yet appeared. It is copiously and beautifully illustrated and the different new species described are dealt with in an exhaustive manner. *Chermes Cooleyi* is the name given to the large and handsome gall found in British Columbia upon the Sitcha Spruce, and the gall, as well as the insect in all its stages of development, are figured and described with great detail. This paper will be welcomed by all homopterists who will be glad to have these different species characterized. In the past nearly all the gall making species of Chermes found on spruce have been called *Chermes abietis*.

Hampson, Sir. George F., (Bart.), Catalogue of the Lepidoptera Phalænæ in the British Museum, Vol. VI, Noctuidæ, 1906, pp. 532, plates XCVI to CVII. Sir George Hampson's new volume appeared early in the year and through his kindness and that of the Trustees of the British Museum was presented to several of the members of our Society who had helped by sending good specimens to the British Museum collection. This volume is of particular interest to Canadians from the large proportion of insects belonging to our fauna which are included among the 692 species described. Of the 322 coloured figures given on the plates no less than 141 species have been already taken in Canada or are quite likely to occur within our limits. The range of the present volume is "the Cucullianæ, the third of the fifteen sub-families into which the Noctuidæ are divided. This subfamily is characterized by its trifid neuration of the hind wing combined with spineless tibiæ and smooth eyes surrounded by eyelashes of bristle-like hairs. It forms a group of genera very closely related to the Acronyctinæ, the lowest of the subfamilies of the Noctuidæ Trifinæ." This volume is of great importance to all North American students. From correspondence with Sir George Hampson it is apparent that there are a great many species of North American Noctuidæ, of which good specimens would be most acceptable for the British Museum. It is manifestly to the advantage of everyone to help now by sending specimens to Sir George Hampson, particularly those concerning the identity of which there is any doubt. He will gladly examine and report upon them. It may be noted that Prof. J. B. Smith, who is one of ourselves, is closely in touch with Sir George Hampson and has been of great assistance to him in the vol me now referred to.

Kearfott, W. D., New North American Tortricidæ; Transactions of the American Entomological Society, Philadelphia, Vol. XXXIII, No. 1, pp. 1 to 98. (Separate signatures mailed as issued between Feb. 2 and March 27, 1907.) In this article 159 species and 4 varieties are described as new, and of these 20 species are from Canada. This valuable contrib tion will be of great value to Canadian students of microlepidoptera, in whose behalf the author has been so untiring in his efforts. Many hundreds of specimens have been submitted to him from collectors in all parts of the country and he has been most generous in naming and returning authoritatively labelled material. Our Ottawa members not only had the great pleasure of meeting Mr. Kearfott when he paid us a short visit last spring but had th privilege of accompanying him to the field, where they got much valuable information as to the best ways of collecting and rearing microlepidoptera. Mr. Kearfott's enthusiasm was an inspiration.

The following is a list of the names and addresses of collectors heard from during 1907.

Anderson, E. M., Provincial Museum, Victoria, B.C.
Albert, Rev. Roger, Maisonneuve, Que.
Baird, Thomas, High River, Alta.
Baldwin, J. W., 74 Besserer Street, Ottawa.
Bédard, Jos., Ste Croix, Que.
Bethune, Rev. Prof., O. A. C., Guelph.
Boulton, A. R. M., c/o King Brothers, Quebec, Que.
Brodie, Dr. W., Provincial Museum, Toronto.
Bryant, Theo., Ladysmith, B.C.
Bush, A. H., 1105 Ninth Ave., Vancouver, B.C.
Chagnon, Gus., Box 186, Montreal.
Cockle, J. W., Kalso, B.C.
Criddle, Norman, Treesbank, Man.
Dawson, Horace, Hymers, Ont.
Denny, Edward, 200 Mitcheson St., Montreal.
Dent, W. A., Sarnia, Ont.
DeWolfe, L. A., Truro, N.S.
Dod, F. H. Wolley, Millarville, Alta.
Evans, J. D., Trenton, Ont.
Fletcher, James, Experimental Farm, Ottawa.
Fyles, Rev. T. W., Levis, Que.
Gibson, Arthur, Experimental Farm, Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Halkett, A., Fisheries Museum, Ottawa.
Hanham, A. W., Duncans, B.C.
Harrington, W. H., P.O. Dept., Ottawa.
Harvey, R. V., Victoria, B.C.
Heath, E. F., Cartwright, Man.
Hudson, A. F., Millarville, Alta.
Jarvis, T. D., O. A. C., Guelph, Ont.
Keele, Jos., Geological Survey, Ottawa.
Keen, Rev. J. H., Metlakatla, B.C.
Létourneau, Jos., Exp. Farm, Ottawa.
Lyman, H. H., 74 McTavish Street, Montreal.
Marmont, L. E., 2553 Second Ave. West, Vancouver, B.C.
McIntosh, W., St. John, N.B.,
Metcalfe, W., 288 Bank Street, Ottawa.
Moore, W. H., Scotch Lake, N.B.
Payne, H. G., Granville Ferry, N.S.
Perrin, Jos., McNab's Island, Halifax, N.S.
Russell, John, Digby, N.S.
Sanson, N.B., Banff, Alta.
Saunders, Henry, 21 Harbord St., Toronto.
Sherman, R. S., 2285 Sixth Ave., Vancouver, B.C.
Simpson, W., Dom'n Observatory, Ottawa.
Taylor, Rev. G. W., Wellington, B.C.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., 99 St. George St., Toronto.
Wallis, J. B., Machray School, Winnipeg, Man.
Williams, J. B., 125 College St., Toronto.
Willing, T. N., Regina, Sask.
Wilmot, E. S., Vernon, B. C.

Wilson, W. J., Geological Survey, Ottawa.
Winn, A. F., 132 Springfield Ave., Westmount, Que.
Young, C. H., Geological Survey, Ottawa.
Zavitz, E. J., O.A.C., Guelph.

NOTES OF CAPTURES.

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U. S. N. M. Bull. No. 52.).

RHOPALOCERA.

(Dyar's number.)

8. *Papilio daunus*, Bdv. Vernon, B.C., (Venables).

11. *Papilio glaucus*, L., a. *turnus*, L. Dr. Henry Skinner, of Philadelphia, took a perfect specimen of the melanic form named *fletcheri* by Kemp, at White River, Ont., on the Canadian Pacific Railway, where it was flying with scores of the ordinary form, around a damp spot below the platform.

14. *Papilio thoas*, L. Several specimens of this southern butterfly were taken in Ontario during the past season; Trenton, Sept. 21, (Evans); Sarnia, Oct. 9, (Dent); Niagara Glen, Sept. 3, (Williams).

16. *Papilio machaon*, L., a *aliaska*, Scudd. Mouth of Campbell Creek, Pelly River, Yukon, July 8, (Keele).

17. *Papilio bairdii*, Edw., a. *oregonia*, Edw. Peachland, B.C., July 27, (Wallis).

38. *Pontia napi*, L., b. *hulda*. Edw. Pelly River, July 13, (Keele).

42. *Synchloe creusa*, D. & H. Laggan, Mount St. Piran, near timber line, July 17, scarce, (Dod); Banff, (Sanson).

62. *Eurymus meadii*, Edw., a. *elis*, Strk. The commonest Colias on the head waters of the Athabasca River, (Mrs. Nicholl).

75. *Eurymus nastes*, Bdv. Near Taku River, Northern British Columbia, August 8, 1906, (Bryant).

128. *Argynnis eurynome*, Edw. c. *artonis*, Edw. Duck Lake, Sask., July 22, (Fletcher).

143. *Brenthis alberta*, Edw. On mountains near the head waters of the Athabasca and Saskatchewan Rivers, fairly swarming in many places, end of July, (Mrs. Nicholl).

144. *Brenthis astarte*, D. & H. On mountains near the headwaters of the Athabasca and Saskatchewan Rivers, end of July (Mrs. Nicholl). Dr. Henry Skinner tells us that 2 specimens were also taken on Mount Athabasca (altitude 7,200 feet) by Mrs. C. Schaeffer, of Philadelphia.

Charidryas hanhami, Fletcher. Treesbank, Man., July 15, several specimens, (Criddle, Fletcher, Skinner).

169. *Cinclidia harrisii*, Scud. Blackburn, Ont., June 28, July 5, (Young) Go Home, Ont. (Walker).

218. *Aglais milberti*, Godt. Scotch Lake, N.B. This species has been observed here since the beginning of October. It is one of the rarest butterflies in this section. (W. H. Moore).

270. *Erebia disa*, Thun., a. *mancinus*, D. & H. Headwaters of Saskatchewan, end of July, (Mrs. Nicholl).

291. *Œneis chryxus*, D. & H., a. *calais*, Scudd. Go Home Bay, Ont., June 16, (Walker). This interesting insect is very little known. The specimens described by Scudder were collected by Drexel from near Rupert House at the south-eastern extremity of Hudson Bay. It has also been taken at Carbonear, Newfoundland. Scudder says "it appears to be confined to the high northern regions of the eastern half of the continent." Its nearest ally is *Œ. chryxus*, a common insect in the main chain of the Rockies.

295. *Œneis norna*, Thun., k. *brucei*, Edw. Banff, Alta., on Sulphur mountain, (Sanson), occuring at from 7,500 to 8,500 feet altitude. Common on all the high mountains at head of Athabasca and Saskatchewan rivers, flying with *beanii*, end of July, (Mrs. Nicholl).

1. *beanii*, Elwes. Banff, on Sulphur mountain at a height of from 7,500 to 8,500 feet. Mount Stephen and Mount Field, B.C., about 7,000 feet, July 7 and 8. I also saw it on a mountain about 12 miles east of Lake Windermere on July 13. About 10 specimens at Mount St. Piran, Laggan, July 16-18, including a female on the summit at about 8,600 feet and another close above Lake Agnes, below timber line, at about 6,800 feet. (Dod.). Summit of Mt. St. Piran, August 4, (Fletcher).

335. *Uranotes melinus* Hbn. Digby, N.S., July 20, (Russell); Peachland, B.C., (Wallis).

383. *Erora læta*, Edw. Meach Lake, Que., June 14, 15, (Young).

409. *Cupido sæpiolus*, Bdv. Female seen ovipositing on the young flower buds of *Hedysarum boreale* at Kinistino, Alta., July 25, (Fletcher).

437. *Rusticus anna*, Edw. Pelly River, below Hoole River, July 5, (Keele).

469. *Pamphila palæmon*, Pallas. Eastman's Springs, Ont., near Ottawa, June 19, several specimens, (Gibson & Young). Only taken once before in the Ottawa district.

488. *Erynnis sassacus*, Harr. Nepigon, July 9, (Fletcher & Skinner); Go Home Bay, Ont., (Walker).

526. *Polites peckius*, Kirby. Banff, July 27, (Sanson).

584. *Epargyreus tityrus*, Fab. Cartwright, Man., June 2, one specimen, a new record for Manitoba, (Heath).

HETEROCERA.

677. *Pholus vitis*, L. McNab's Island, Halifax, N.S., Aug. 29, (Perrin). An immigrant from the South, Mr. Perrin says that his specimen answers well to the figure of *P. fasciatus* as shown on Plate 3 of Holland's Moth Book.

683. *Ampelophaga versicolor*, Harr. Ottawa, August 18, (Baldwin), Montreal, July, specimen taken at Lafontaine Park, collector unknown, record sent by Mr. Winn. The larvæ feed on *Nesæa verticillata* and should be looked for in August.

704. *Sphinx luscitiosa*, Clemens. Tukon River, branch of Megiskan River, July 20, (Wilson).

713. *Sphinx canadensis*, Bdv. Ottawa, July 6, (Baldwin); Quebec, July 3, (Boulton), Montreal, July, (E. C. Barwick).

778. *Basilona imperialis*, Dru. Kingston, Aug. 12, (Klugh). Larva found feeding on red and white pine in Simcoe County, Sept. 15, (Zavitz).

846. *Ecpantheria deflorata*, Fab. Niagara Glen, June 30, (Hahn).

861. *Phragmatobia assimilans*, Wlk., a. *franconica*, Slosson. Montmorency Falls, Que., June 14, and flying in bright sunshine at Lake Beauport, Que., June 23, (Boulton).

869. *Neoarctia yarrowi*, Stretch. Mount Stephen, Field, B.C., July 7, a fresh female at rest on a rock in hot sunshine, alt. 7,000 feet. I took a larva in first moult nearby, and bred a male on July 29, from a full fed larva found on a rock in hot sunshine on the top ridge of Mount Field, on July 8. This was of the ordinary woolly bear type with moderately long hairs, black mixed with dark red. The younger larvæ were less black, and refused all food offered. I also took a half grown larva high up on Mount St. Piran, Laggan, on July 17. All of these specimens were above timber line (Dod.)

874. *Apantesis virgo*, L., a. *citrinaria*, N. & D., Ottawa, Aug. 4, (Baldwin).

958. *Panthea portlandia*, Grt. A female on electric lamp, July 16, Field, B.C., (Dod).

960. *Panthea acronyctoides*, Walker. McNab's Island, Halifax, N.S., (Perrin).

982. *Apatela leporina*, L. Larvæ sent from North Head, N.B., Sept. 26, by Mr. M. R. Tuttle, and from Halifax, N.S., by Mr. C. H. Churchill. This is the first record we have of the species occurring in New Brunswick and Nova Scotia.

999. *Apatela radcliffei*, Harvey. Montreal about end of June, (Denny); Ottawa, mature larva found on apple, Sept. 26, (Létourneau).

1,008. *Apatela funeralis*, Grt. Montreal, June 4 and 21, July 15 and 27, (Denny); Ottawa, June 10, bred from maple, (Young).

1,012. *Apatela vinnula*, Grt. Digby, July 5, Aug. 9, (Russell); Ottawa, (Fletcher).

1,028. *Apatela retardata*, Wlk. St. John's, Que., July 1, (Chagnon); Ottawa, June 12, (Gibson), June 16, (Fletcher); Digby, June 26, (Russell).

1,046. *Apharetra dentata*. Grt. Digby, Aug. 29, (Russell).

1,078. *Hadenella minuscula*, Morr. Digby, Aug. 3, 1906, Sept. 14, 19, 1907, (Russell). In Dr. Smith's list this species appears as *Hadena minuscula*.

1,146. *Hillia algens*, Grt. Hymers, August, (Dawson); Montreal, (Winn).

1,149. *Hadena bridghami*, G. & R., Digby, Aug. 29, Sept. 12, (Russell).

Hadena ferens, Sm. Windermere, B.C., 3 specimens at light, July 11, 12, (Dod). New to British Columbia.

Hadena alberta, Sm. Calgary, a few at light, July 11 to Aug. 18, (Hudson).

Hadena miniota, Sm. Cartwright, one specimen Aug. 22, (Heath).

Hadena enigra, Sm. Calgary, one at light, July 11, (Hudson).

Hadena maida, Dyar. Kalso, Aug. 7 (Cockle); Glacier, B.C., (Mrs. Nicholl, *fide* Hampson, Cat. VI, p. 344).

1,221. *Hadena apamiformis*, Gn. St. Hilaire, Que., July, (Chagnon).

1.252.1. *Hadena semilunata*, Grt. Gleichen, Alta., one on flowers of Western Snowberry, July 22. I have not seen this for years. (Dod.)

1,279. *Hyppa indistincta*, Sm. Laggan, a female at light, July 18. "Agrees with the figure and description. I have the same species from Kalso and consider it distinct from *brunneicrista*." (Dod.).

1,302. *Laphygma frugiperda*, S. & A., and var. a. *obscura*, Riley. Both common at sugar and light throughout September, at Montreal, (Winn & Denny).
1,341. *Oncocnemis atrifasciata*, Morr. Truro, N.S., (DeWolfe).
1,347. *Oncocnemis major*, Grt. Aweme, July 13, (Fletcher).
1,353. *Oncocnemis pudorata*, Sm. Lake Agnes, Laggan, Alta., Hope Pass, B.C., (Mrs. Nicholl, *fide* Hampson, Cat. VI, p. 154).
1,360. *Oncocnemis regina*, Sm. Pile of Bones hill, 6 miles north of Regina, Aug. 10, 1886, (Fletcher). See Hampson, Cat. VI, Pl. XCIX., fig. 15.
1,429. *Semiophora youngii*, Sm. Digby, Aug. 9, (Russell).
1,533. *Rhizagrotis lagena*, Grt. Red Deer River, near Gleichen, a few at sugar, July 23 and 24, (Dod).
1,579. *Paragrotis plagigera*, Morr. Calgary, July 30 and Aug. 24, at light, (Dod and Hudson). Not seen for years. This species is erroneously recorded as *olivalis* in my Calgary list. (Dod.)
1,584. *Paragrotis pugionis*, Sm. Calgary, Sept. 7, (Dod.); Aweme, July 13, (Criddle and Fletcher); Beulah, Man., (Dennis); High River, Alta., (Baird).
1,599. *Paragrotis fumalis*, Grt. Rostrevor, Lake Rosseau, Sept. 3. (Gibson).
1,630. *Paragrotis vulpina*, Sm. Calgary, Sept. 23, (Dod).
1,695. *Paragrotis tristicula*, Morr. Windermere, B.C., July 12, at light, (Dod.) New to B.C.; Truro, N.S., (De Wolfe). A totally unexpected locality for this species. (J. B. S.)
1,725. *Paragrotis infusa*, Sm. Calgary, Sept. 2, (Dod). New to Alberta.
Paragrotis criddlei, Sm. Aweme, Aug. 24, '06, (Criddle).
Paragrotis cocklei, Sm. Kaslo, July 27, '04 (Cockle); Peachland, B.C., July 7, (Wallis).
1,732. *Paragrotis nordica*, Sm. Redvers, Sask., Aug. 3, '06 (A. J. Crocker, through A. F. Winn).
1,775. *Mamestra purpurissata*, Grt. var. *crydina*, Dyar. Windermere, B. C., July 10, one specimen. This agrees with specimens from Kaslo, the type locality. Dr. Smith claims that it is clearly a distinct species. (Jour. N.Y. Ent. Soc. XV, 152, Sept. 1907.) (Dod.)
1,825. *Mamestra goodelli*, Grt St. Hilaire, Aug. 5, (Chagnon). A northern or mountain species, (J. B. S.).
1,840. *Mamestra sutrina*, Grt. Victoria, Aug. 29, (Anderson); Laggan, B.C., July 16, (Dod). Field, B.C., June 6, (Mrs. Nicholl).
Mamestra artesta, Sm. High River, (Baird).
1,890. *Morrisonia confusa*, Hub. Montreal, June 4, (Denny).
1,905. *Xylomiges tabulata*, Grt. Montreal, 1906, (Denny).
1,998. *Orthodes vecors*, Gn. St. Hilaire, Que., July 10, (Chagnon).
2,111. *Xylina thaxteri*, Grt. Truro, Sept. 18. (De Wolfe).
2,120. *Calocampa cineritia*, Grt. Truro, (De Wolfe); Montreal, (Denny); Ottawa, Oct. 17, (Young).
Cucullia indicta, Sm. Calgary, (Dod, *fide* Hampson, VI., p. 70).
2,138. *Copicucullia antipoda*, Strck. Penticton, B.C., (Mrs. Nicholl, *fide* Hampson, VI. p. 11.).
2,152. *Nonagria oblonga*, Grt. Trenton, June 24, (Evans).
2,165. *Gortyna immanis*, Gn. Ottawa, Sept. 14, (Fletcher); Rostrevor Muskoka, Ont., Sept. 8, (Gibson).
2,167. *Gortyna obliqua*, Harvey. Aweme, Aug. 28, (Criddle).
2,171. *Papaipema cerina*, Grt. Aweme, at light, one splendid specimen, Oct. 1, (Criddle).

2,175. *Papaipema harrisii*, Grt. Hymers, larvæ found in stems of *Heracleum lanatum*, imago 2 Sept., (Dawson); Aweme, reared from same food plant, Aug. 23, (Criddle).

Papaipema pterisii, Bird. Last year we recorded under the name of *Papaipema harrisii*, Grt., var., some Ottawa specimens reared from *Pteris aquilina*. Mr. Bird now informs us that this is not a variety of *harrisii* but a new species which he has described under the above name.

Papaipema ærata, Lyman, (not *P. nelita*, Strck.). Bred again for the fourth time from burdock, in the type locality, Montreal, (Lyman).

Papaipema eupatorii, Lyman. Montreal, one specimen bred from *Eupatorium purpureum*, (Lyman).

2,221. *Orthosia ralla*, Montreal, Aug. 24, (Chagnon).

2,288. *Nycterophæta luna*, Morr. Red Deer River, near Gleichen. Three specimens on thistle heads, July 24-26: two asleep after a rain storm, (Dod); Rudy, Sask., July 19, (Willing).

2,361. *Schinia marginata*, Haw. Ottawa, Aug. 25, (Gibson). A new record for the Ottawa district.

2,389. *Dasyspoudæa lucens*, Morr. Aweme, June 21, (Criddle). This is the first Canadian record of this beautiful little moth, which belongs to the Coloradan fauna.

2,395. *Melanoporphyria immortua*, Grt. Redvers, Sask., June 9, 1906, (A.Y. Crocker); Aweme, Man., June 21, (Criddle).

2,406. *Melicleptria sueta*, Grt. Vernon, (Venables).

2,420. *Heliaca diminutiva*, Grt. Red Deer River, near Gleichen, July 25 and 26, not common, (Dod).

2,423. *Heliaca nexilis*, Morr. Laggan, Mt. St. Piran, at about 7,000 feet, not rare, July 16-18, (Dod). Wilson Pass, near head of Saskatchewan River, July 22, (Mrs. Nicholl); Banff, (Fletcher, Sanson).

2,472. *Polychrysia moneta*, Fab., a. *esmeralda*, Oberthur. Calgary, July 30 and Aug. 13, (Dod).

2,528. *Autographa Sackeni*, Grote. Brazeau Creek, Rockies, Aug. 3, one specimen, (Mrs. Nicholl).

2,477. *Autographa metallica*, Grt. Duncans, B.C., 2 specimens, (Hanham).

2,487. *Autographa rogationis*, Gn. Toronto, May 3, 1897, Ottawa, (Gibson).

2,504. *Autographa v-alba*, Ottol. Kalso, (Cockle). *Teste* Ottolengui.

2,524. *Autographa corrusca*, Strk. Duncans, occasional, on the wing, July, Aug. and Sept., (Hanham).

2,532. *Syngrapha parilis*, Hub. Mt. Saskatchewan (7,500 feet), July 27, rather common (Mrs. Nicholl). This is the species figured by Ottolengui as *parilis* but by Holland as *devergens*, (Dod).

2,535. *Syngrapha devergens*, Hub. Wilcox Pass, Rockies, Alta., July 26, (Mrs. Nicholl *per* Dod).

2,696. *Fruva tortricina*, Zell. Calgary, one at light, July 30, (Dod).

2,769. *Melipotis limbolaris*, Geyer. Digby, July 28, (Russell).

2,836. *Catocala luciana*, Hy. Edw. Cartwright, at sugar, Sept., (Heath).

2,846. *Catocala pura*, Hulst. Cartwright, at sugar, Sept. 10, (Heath).

2,893. *Catocala pretiosa*, Lint. Cartwright, Sept. 10, (Heath).

2,953. *Strenoloma lunilinea*, Grt. Granville Ferry, N.S., (Payne). First Canadian record.

2,983. *Ypsia undularis*, Dru., *a. æruginosa*, Gn. Digby, June 6, (Russell).

3,036. *Philometra metonalis*, Wlk. Windermere, B.C., July 10-12, not rare, new to B.C., (Dod).
3,063. *Lomanaltes eductalis*, Wlk. Digby, June 24, (Russell).
3,117. *Notodonta simplaria*, Graef. Aweme, July 4, Aug. 9, (Criddle).
3,140. *Heterocampa biundata*, Wlk. Truro, July 24, (De Wolfe).
3,142. *Heterocampa bilineata*, Pack. Aweme, June 17, (Criddle).
3,145. *Ianassa lignicolor*, Wlk. Quebec, Aug. 15, (Boulton).
3,353. *Eustroma nubilata*, Pack. Digby, N.S., (Russell). A western moth, which I am rather surprised to see from Nova Scotia. (G. W.T.)
3,387. *Hydriomena sordidata*, Fab., c. *quinquefasciata*, Pack. Skagway District, northern B.C., (White-Fraser & Smith).
3,395. *Hydriomena contracta*, Pack. Ottawa, Sept. 10, (Fletcher); Rostrevor, Muskoka, Sept. 15, (Gibson); Digby, Aug. 16, (Russell). [This name should be *H. contractata*, Pack. (G.W.T.)].
3,449. *Petrophora incursata*, Hbn. Field and Emerald Lake, B.C., July 2-7; Laggan, July 18, up to 6,500 feet, (Dod); Crown Mountain, Vancouver, July 9, (Harvey).
Petrophora fossaria, Taylor. Lake Agnes, Laggan, July 18, (Dod).
3,620. *Deilinea borealis*, Hulst. Banff, June 24, a pair, (Mrs. Nicholl).
3,734. *Cymatophora denticulodes*, Hulst. Calgary, one male at light, Aug. 3, (Dod).
3,743. *Anthelia taylorata*, Hulst. Vancouver, May 8, (Harvey).
3,873. *Nacophora quernaria*, S. & A. McNab's Island, Halifax, emerged March 23, (Perrin).
3,878. *Jubarella danbyi*, Hulst. Vancouver, one at light, April 13, (Sherman).
3,933. *Plagodis approximaria*, Dyar. Kalso, May 3, (Cockle).
3,954. *Euchlæna serrata*, Dru. Trenton, July 12, not taken here before, (Evans).
4,000. *Marmarea occidentalis*, Hulst.. Vancouver, July 1, (Harvey); Duncans, B.C., at light, July, a much larger species than *Azelina ancetaria*, flying a week or two earlier, (Hanham).
4,040. *Leucobrephos brephoides*, Wlk. Mentioned in previous records as *middendorfi;* see Dr. Smith's article, Can. Ent. Nov. 1907. Three specimens, Mayo River, Yukon Territory, April 16, 1907, (J. A. Davidson, through Mr. J. Keele). These were of a very dark form similar to two specimens taken by Dr. A. P. Low, on the portage at Grand Falls, Hamilton River, Labrador, May 12, 1894.
4,106. *Tortricidia testacea*, Pack. Duncans, three specimens at light, in July. Not previously reported from Vancouver Island, Hanham).
4,409. *Phlyctænia acutella*, Wlk. Toronto, (Metcalfe); Ottawa, (Young).
4,514. *Pyralis costiferalis*, Wlk. Trenton, one specimen, July 22, (Evans).
4 583. *Crambus myellus*, Hbn. Vernon, (Venables).
4,977. *Pterophorus kellicottii*, Fish. Ottawa, (Young).
Exartema merrickanum, Kearf. Rouville, Que., July 5, (Chagnon); Ottawa, (Young).
5,033. *Olethreutes capreana*, Hbn. Sudbury, (Evans).
Olethreutes wellingtoneana, Kearf. Wellington, B.C., May 19, (Taylor).
Olethreutes removana, Kearf. Aweme, Aug. 16, (Criddle).
Olethreutes provana, Kearf. Wellington, April, (Taylor).
Olethreutes galaxana, Kearf. Vernon, April 13—May 13, (Venables).

Olethreutes glitranana, Kearf. Aweme, June 29, (Criddle); Regina, July 2, (Willing); Winnipeg, (Hanham).
Olethreutes coronana, Kearf. Aweme, July 9, (Criddle); Beulah, Man., Aug. 15, (A. J. Dennis).
Eucosma fuscana, Kearf. Rounthwaite, Man., July, (L. E. Marmont).
Eucosma tomonana, Kearf. Westmount, Que., (Winn).
Eucosma johnsonana, Kearf. Victoria, (Taylor).
Eucosma hohana, Kearf. Mount St. Piran, Alta., Aug. 17, (Dr. W. Barnes).
Eucosma heathiana, Kearf. Cartwright, (Heath).
Eucosma solandriana, Hbn. Montreal, June 22, (Winn); Ottawa, (Young).
Eucosma madderana, Kearf. Rounthwaite, July (Marmont); Regina, (Willing).
Thiodia awemeana, Kearf. Aweme, May 20 to June 29, (Criddle); Beulah, (Dennis).
Thiodia asphodelana, Kearf. Calgary, head of Pine Creek, July 2, (Dod).
5,200. *Thiodia montanana*, Wlsm. Aweme, Aug. 25, (Fletcher).
Thiodia timidella, Clem. Montreal, June 9, (Chagnon).
Proteopteryx marmontana, Kearf. Rounthwaite, June 11, (Marmont); Aweme, July 12-24, (Criddle); Prince Albert, Sask., July 19, (Criddle); Regina, July 15, (Fletcher).
Proteopteryx criddleana, Kearf. Aweme, July 24, Aug. 13, (Criddle); Rounthwaite, July, (Marmont).
Proteoteras torontana, Kearf. Toronto, June 5, (Gibson).
Epinotia watchungana, Kearf. Aylmer, Que., June 8, (Gibson);
Epinotia plumbolineana, Kearf. Wellington, June, (Taylor and Bryant).
Epinotia normanana, Kearf. Aweme, June 27, (Criddle).
Enarmonia prosperana, Kearf. Vernon, (Venables).
Enarmonia vancouverana, Kearf. Wellington, June, (Bryant).
Enarmonia youngana, Kearf. Ottawa, (Young).
Enarmonia cockleana, Kearf. Ottawa, (Young).
Enarmonia saundersana, Kearf. Toronto, May 24, to June 11, (Saunders).
5,276. *Enarmonia americana*, Wlsm. Ottawa, June 11, (Gibson).
5,314. *Acleris nivisellana*, Wlsm. Rostrevor, Muskoka, Sept. 7, (Gibson).
Epagoge lycopodiana, Kearf. Ottawa, (Young).
5,353. *Sparganothis flavibasana*, Fern. Ottawa(larvæ common on cultivated Honeysuckle (*Lonicera Japonica*), June 19, moths emerged July 2 to 6, (Kearfott and Gibson).
Hysterosia tiscana, Kearf. St. Hilaire, July 7, (Winn).
Hysterosia cartwrightiana, Kearf. Cartwright, (Heath).
Carposina ottawana, Kearf. Ottawa, (Young).
Kearfottia albifasciella, Fern. Ottawa, (Young).
5,524. *Choreutis silphiella*, Grt. Vernon, (Venables).
Recurvaria gibsonella, Kearf. Ottawa and Hull, Que., moths emerged June 29 to July 6, (Gibson).
Recurvaria coniferella, Kearf. Ottawa, June 20, (Gibson).
Trichotaphe levisella, Fyles. Levis, Que., (Fyles).
Gelechia fondella, Busck. Aweme, May 30 to June 20, (Criddle); Beulah, (Dennis), Rounthwaite, (Marmont).

5,834. *Stenoma schlægeri*, Zell. Truro, July 17, (De Wolfe).
5,876. *Depressaria sabulella*, Wlsm. Ottawa, in house, April 16, (Gibson).
5,879. *Depressaria lythrella*, Wlsm. Rostrevor, Muskoka, Sept. 7, (Gibson).
Mompha claudella, Kearf. Rounthwaite, July 11, (Marmont).
6,265. *Lithocolletis ostensackenella*, Fitch. Trenton, May 11, (Evans).
Incurvaria taylorella, Kearf. Wellington, (Taylor).
Monopis monachella, Hbn. Aweme, Aug. 25, (Fletcher); St. Hilaire, July 7, (Winn); Rouville, Que., July 5, (Chagnon).
6,531. *Tinea arcella*, Fab. Montreal, June 21, (Winn).

Coleoptera.

(Arranged according to Henshaw's List of the Coleoptera of America, North of Mexico.)

30*a*. *Cicindela limbata*, Say. Rudy, July 19; Radisson, Sask., July 29, (Fletcher, Willing, Skinner).
35. *Cicindela hirticollis*, Say. Rudy, Sask., July 19, (Fletcher).
35. *Cicindela cinctipennis*, Lec. Running on high dry prairie among the grass, Rudy, July 19, (Willing).
116. *Carabus mæander*, Fisch. Kinloss, Ont., July 16, '98, (per W. Brodie).
188. *Nebria metallica*, Fisch, var. Metlakatla, B.C., (Keen).
645. *Amara fulvipes*, Putz. One specimen from Glen Ross, Hastings Co., May 10, 1902, not previously recorded from Canada, (Evans).
728. *Dicælus teter*, Bon. North Bruce Co., Ont., (per W. Brodie).
788. *Platynus tenuis*, Lec. Trenton, June, 19, Aug. 11, never taken here before, (Evans).
803. *Platynus ferreus*, Hald. North Bruce Co., (per W. Brodie).
1,057. *Piosoma setosum*, Lec. Rudy, July 20, (Fletcher).
1,477. *Hydaticus stagnalis*, Fab. Ottawa in moss (Dr. H. M. Ami). Mr. Harrington has only twice found the species.
1,487. *Dytiscus circumcinctus*, Ahr. Reference was made in last year's *Entomological Record* to large numbers of this beetle having been taken at electric lights in Winnipeg during the month of October. On Oct. 4 of the present year, Mr. Evans again collected in Winnipeg, over one hundred specimens in the same manner, and about the same time, Mr. T. N. Willing records that enormous numbers of the same species appeared in Regina when his two boys collected for him a pickle jar full and then stopped.
1,791. *Cyrtusa blandissima*, Lec. Aweme, Man., June and July; burrowing in the sand in company with *Ochodæus simplex* and *Bolboceras lazarus*. Found in the burrows made by the larger species, (Criddle).
1,881. *Tychus cognatus*, Lec. Metlakatla, (Keen).
Batrisus zepharinus, Casey. Metlakatla, (Keen).
3,062. *Coccinella tricuspis*, Kirby. Peachland, B.C., (Wallis).
3,095*a*. *Brachyacantha albifrons*, Say. Aweme July 11, (Criddle).
3,148. *Scymnus collaris*, Melsh. Aweme, July 14, (Criddle).
3,734. *Pocadius helvolus*, Er. Reared from a *Lycoperdon*, Grand Forks, B.C., Aug., 1904, (Fletcher).
4,093. *Alaus oculatus*, L. Vernon, July 8, (Wilmot).
4,369. *Limonius subauratus*, Lec. Vancouver, May 4, (Harvey).
4,382. *Pityobius anguinus*, Lec. Granville Ferry, N.S., (Payne).

4,589. *Dicerca pectorosa*, Lec. Kaslo, June 25, (Cockle).
4,594. *Pœcilonota cyanipes*, Say, Radisson, July 29, on *Populus tremuloides* and *P. balsamifera*, common, (Fletcher, Willing, Skinner).
4,600. *Buprestis confluens*, Say. Makinak, Man., (per G. Chagnon); Aweme, July 16, Aug. 9, rare, (Criddle).
4,729. *Agrilus granulatus*, Say. Makinak, Man., (per G. Chagnon).
4,779. *Celetes basalis*, Lec. Aweme, July 5 and 9, rare, (Criddle).
4,913. *Silis spinigera*, Lec. Kaslo, June 2, (Cockle).
5,027. *Malachius thevenetii*, Horn. Kaslo, June 5, (Cockle).
5,110. *Dolichosoma foveicolle*, Kirby. Aweme, July 9, (Criddle).
5,380. *Priacma serrata*, Lec. Kaslo, May 15, (Cockle). Mr. Cockle took a fine pair of this rare beetle at Kaslo. We know of no other Canadian captures. It was described by Dr. J. L. Leconte in 1861 from "East of Fort Colville at Sinyak Water depot and at Camp Kootenay." Dr. Leconte notes the variation in the size of this remarkable species, length .43 to .82 inch.
5,579. *Ochodœus simplex*, Lec. Aweme, burrowing in sand, July 4-13, (Criddle).
5,591. *Bolboceras lazarus*, Fab. Aweme, July 19, (Criddle).
5,594. *Odontœus obesus*, Lec. Aweme, Sept. 2 and 7, in hole in ground, (Criddle); Rudy, July 19, (Henry Skinner).
5,822. *Polyphylla decemlineata*, Say. Rudy, July 19, (Willing).
5,948. *Spondylis upiformis*, Mann. North Bruce County, May 17, '87, (per W. Brodie); Bear Canyon, B.C., May 30, '85, (per W. Brodie); Banff, (Sanson).
5,986. *Gonocallus collaris*, Kirby. Illecillewaet, B.C., May 1, '85, (per W. Brodie).
6,049 *Romaleum simplicicolle*, Hald. Port Sydney, Ont., August, 1890, (Brodie).
6,181. *Xylotrechus quadrimaculatus*, Hald. Ridgeway, Ont., July 28, emerging from branches of Sugar Maple, (Zavitz); Ste. Croix, Que., (Bédard).
6,222. *Desmocerus auripennis* Chev. Glacier, B.C., Aug. 26, (Fletcher).
6,233. *Centrodera decolorata*, Harr. Port Sydney, August, (Brodie).
6,248. *Pachyta liturata*, Kirby. Sulphur Mountain, Banff, Alta., July 30, a black variety, (Sanson).
6,268. *Acmœops vincta*, Lec. Kaslo, May 14, (Cockle).
6,398. *Goes debilis*, Lec. North Bay, June 3, (Brodie).
6,478. *Saperda calcarata*, Say. Peachland, B.C. July, (Wallis).
6,480. *Saperda candida*, Fab. Scotch Lake, N.B., (W.H. Moore); St. John, N.B., (J. Gordon Leavitt). This beetle seems to be very much rarer in the Maritime Provinces than it is in Ontario and Quebec.
6,514. *Tetraopes quinquemaculatus*, Hald. Aweme, July 25, (Criddle).
6,523. *Donacia pubicollis*, Suffr. Qu'Appelle Lakes, July, (Halkett).
6,628*a*. *Cryptocephalus ornatus*, Fab. Aweme, July 10, (Criddle).
6,628*c*. *Cryptocephalus cinctipennis*, Rand. Aweme, July 17, (Criddle).
6,742. *Chrysochus cobaltinus*, Lec. Nelson, B.C., August 19, abundant on *Apocynum androsœmifolium*, (Fitzroy Kelly).
6,781. *Entomoscelis adonidis*, Fab. Near Sixty-one mile River (141 Meridian), Yukon, (T. P. Reilly). The farthest record north we have of the species.
6,795. *Chrysomela exclamationis*, Fab. Aweme, Sept. 6, (Criddle).

6,810. *Chrysomela multipunctata*, Say. This fine species was extremely abundant on willows along the Saskatchewan River at Rudy on July 19, (Fletcher and Willing).

6,827. *Plagiodera oviformis*, Lec. Aweme, June 20, (Criddle).

7,396. *Cœlocnemis dilaticollis*, Mann. Vernon, under logs, June, (Venables); Banff, (Sanson); Peachland, (Wallis).

7,994. *Dendroides canadensis*, Lat. Trenton, June 17 to Aug. 8, five specimens. I have not taken this species for many years, (Evans). Two specimens were brought back from the Skagway District in Northern British Columbia, by G. White-Fraser and R. Smith.

8,134. *Cantharis viridana*, Lec. Rudy, July 20, (Fletcher).

8,271. *Amnesia ursina*, Horn. On raspberries, destructive to the buds, Vernon, B.C., (Venables); Victoria B.C. (Taylor).

8,331. *Evotus naso*, Lec. Rudy, on willows, July 20, (Fletcher); Kelowna, B.C., on apple, (F. J. Watson).

8,427. *Phytonomus punctatus*, Fab. Harrison, B.C., August, (Wilmot). The Clover Leaf Weevil was found on Vancouver Island for the first time in 1902, by Mr. Hanham. Mr. Wilmot's record shows that it has now worked its way up the Fraser valley as far as Harrison.

8,482. *Hypomolyx pineti*, Fab. Skagway District of Northern British Columbia, (White-Fraser and Smith).

8,498. *Lixus concavus*, Say. Ottawa, September, three specimens found on *Polygonum pennsylvanicum*, (Young). This is the Rhubarb Weevil which in some parts of the United States has sometimes given trouble, but is rare in Canada. This is the first time the species has been recorded from the Ottawa District.

8,607. *Otidocephalus chevrolatii*, Horn. Meach Lake, Aug. 1, (Young).

8,676. *Orchestes rufipes*, Lec. This rare little weevil was very abundant and destructive to willows at Ottawa in Sept., the larvæ mining in the leaves and the mature beetles eating out the surface in a similar way to flea-beetles, (Fletcher).

9,667. *Amblopusa brevipes*, Casey, var. Metlakatla, (Keen).

10,767. *Nocheles vestitus*, Casey. Kelowna, injuring buds of Apple, May, 1892, (F. J. Watson).

Nocheles torpidus, Lec. New Denver, B.C., June 14, (W. D. Mitchell); Grand Forks, B.C., June 6, (M. Miller).

Hymenoptera.

Work among the hymenoptera seems to have lagged behind a good deal during the last three years. This is much to be regretted, owing to the great importance of these insects. Moreover, the difficulty in separating the genera and species is sometimes so great that it alone should serve as a stimulus to those who are looking for a specialty in which they may do good work. A few records have been received, which it is well to include here. A collection of *Bombi* has been sent to Mr. H. J. Franklin, of Amherst, Mass., who is making a specialty of these insects, and who has kindly furnished the names of a few of the more interesting which are here given as a beginning. It is to be hoped that these will be largely added to in succeeding years. The wasps and bees present excellent fields for special work.

Zaræa inflata, Nort. Trenton, reared from larvæ feeding upon a shrub in my garden last year; more larvæ were found this year, (Evans).

Labidia opinus, Cress. Kaslo, Aug. 11, (Cockle).

Pamphilius ruficeps, Hargtn. Toronto, July 30, '88, (Metcalfe); Ottawa, May 31, (Harrington); Maisonneuve, near Montreal, Que., (Albert). This handsome sawfly seems to be rare. Another specimen was taken in Montreal some years ago by Rev. C. J. Ouellet.

Oryssus occidentalis, Cress. Peachland, B.C., July, (Wallis).

Diastrophus cuscutæformis, O.S. Guelph, in galls on stems of *Rubus villosus*, (Jarvis).

Diastrophus potentillæ, Bass. Perth, in round galls on stems of *Potentilla canadensis*, (Jarvis). Youghall, N.B., July, (Fletcher).

Diastrophus turgidus, Bass. Guelph, on stems of *Rubus strigosus*, (Jarvis).

Andricus punctatus, Bass. Guelph, on stem of *Quercus coccinea*, (Jarvis).

Andricus seminator, Harr. London, Ont., from galls on *Quercus alba*, (J. Dearness).

Andricus topiarius, Ashm. Guelph, leaf galls of *Quercus macrocarpa*, (Jarvis).

Biorhiza forticornis, Walsh. Gravenhurst, Ont., galls on *Quercus alba*, (Jarvis); very abundant on young shoots of *Quercus macrocarpa*, Rivers, Man., (Fletcher).

Pristaulacus melleus, Cress. Kaslo, June 3-30, (Cockle).

Ichneumon caliginosus, Cress. Kaslo, bred from pupa of *Grapta satyrus* found at Montezuma mine, South fork of Kaslo Creek, B.C., emerged Sept. 7, (Fletcher). Mr. Harrington has taken several specimens of this widely distributed species at Ottawa.

Ichneumon milvus, Cress. Ottawa, Aug, 22, (Harrington). Meach Lake, Sept. 1, (Fletcher). One of our rarest ichneumons.

Trogus brullei, Cress. Maisonneuve, near Montreal, (Albert).

Trogus fulvipes, Cress. Kaslo, ex pupa of *Papilio eurymedon*, May, (Cockle); ex pupa of *P. turnus*, Digby, Oct. 2, (Russell); Aweme, July 14, (Fletcher).

Trogus fletcheri, Hargtn. Bred from pupa of *Papilio eurymedon*, Wellington, B.C., (Taylor).

Cryptus proximus, Cress. Kaslo, May, (Cockle).

Ephialtes occidentalis, Cress. Kaslo, July 20, (Cockle).

Ephialtes variatipes, Prov. Kaslo, July 4, (Cockle); Ottawa, (J. A. Guignard).

Rhyssa persuasoria, L. Millie Lake, near height of land, Hudson Bay Slope, July 26, (Wilson).

Thalessa nortoni, Cress. Hymers, (Dawson). Metlakatla, B.C., (Keen).

Lampronota marginata, Prov. Levis, Que., reared from *Trichotaphe levisella*, (Fyles).

Spilochalcis (Chalcis) encausta, Cress. Aweme, three specimens of this beautiful and grotesque little insect were taken by Mr. Evelyn Criddle, July 17.

Masaris marginalis, Cress. Kaslo, June 2, (Cockle). This is the first specimen of this genus to be recorded from Canada. It is a slender wasp-like insect but has clubbed antennæ.

Bombus borealis, Kirby. Nepigon, Ont., July 1, '88, Ottawa, Aug. 27, '02, (Fletcher).

Bombus californicus, Smith. Prince Albert, July 6, 1900, an extreme variation; Calgary, July 17, nearly typical, (Fletcher).

Bombus fervidus, Fab. McLeod, Alta., June 20, (Fletcher).

Bombus huntii, Greene. McLeod, June 20, (Fletcher).

Bombus impatiens, Cress. Ottawa, Oct. 2, '02, (Fletcher).

Bombus kirbyellus, Curtis. Fullerton, Hudson Bay, July, 1904, (Halkett); Mount Edith, Banff, July 7, '02, (Fletcher.)
Bombus melanopygus, Mylander. Mount Edith, Banff, July 7, '02, (Fletcher).
Bombus nevadensis, Cress. Vernon, June, (Venables); McLeod, Alta., June 20, '02, (Fletcher and Willing); High River, Alta., a magnificent melanic specimen, the whole body uniformly black, (Baird).
Bombus occidentalis, Greene. Banff. Aug. 28, (Sanson).
Bombus pennsylvanicus, De Geer. Ottawa, (Fletcher).
Bombus perplexus, Meach Lake, July 20, '05, (Gibson).
Bombus sylvicola, Kirby. Fullerton, June 20, '04, (Halkett).
Bombus ternarius, Say. Prince Albert, July 6, '00, (Fletcher).
Bombus terricola, Kirby. Kebinakagami River, near height of land, Hudson Bay slope, Aug. 2, '03, (Wilson).
Bombus vagans, Smith. Nepigon, July 1, '88.; Ottawa, Aug. 25, May 5, (Fletcher).
Psithyrus interruptus, Greene. Mount Edith, Banff, July 7, '02, (Fletcher).
Psithyrus laboriosus, Fab. Ottawa, April 26, 01, (Fletcher).

Hemiptera.

Several additions have been made during the past summer to the collections of Canadian hemiptera, most of them to the sub-order homoptera. Unfortunately, few of the records have been sent in with sufficient data to warrant their inclusion here. Useful notes on these insects, as with all others, give the date of capture, the locality, and, when possible, the nature of the food. The following list from Mr. J. D. Evans, of Trenton, is the most complete and is submitted because many of the insects mentioned are new to the Canadian list. Mr. Van Duzee, who kindly identified the material, considers their capture worthy of being put on record.

Helicoptera septentrionalis, Prov. Sudbury, June 6.
Helicoptera opaca, Say. Co. Hastings.
Heliria strombergi, Godg. Sudbury, Aug. 8, 1889.
Cyrtolobus discoidalis, Emm. Belleville.
Cyrtolobus trilineatus, Say. Belleville.
Telamona Westcotti, Godg. Belleville.
Telamona decorata, Ball. Belleville.
Telamona compacta, Ball. Halifax, N. S., June, 1897.
Scaphoideus lobatus, Van D. Trenton, Sept. 3, '01.
Athysanus osborni, Van D. Trenton, Aug. 15, '01.
Thamnotettix belli, Uhler. Trenton, June 6, '01.
Xestocephalus fulvocapitatus, Van D. Trenton, Aug. 29, '01.
Aphrophora Signoreti, Fitch. Co. Hastings.
Gypona cinera, Uhler. N.W. Terr.
Pediopsis canadensis, Van D. Co. Hastings, June 27, '03.
Bythoscopus sobrius, Walker. Sudbury, 1892.

Mr. T. D. Jarvis, of Guelph, in connection with his studies of vegetable galls and scale insects has found the following species, which are of interest from the localities where found.

Pseudococcus trifolii, Forbes. On roots of white clover at Collingwood.
Chionaspis salicis, L. Guelph, on leatherwood (*Dirca palustris*).

Aspidiotus æsculi, Johnson. On basswood (*Tilia americana*), Toronto, Brantford, Guelph.

Aspidiotus diffinis, Newst. Guilds, Ont., on *Tilia americana*.

Aspidiotus osborni, Newell & Ckll. Toronto, on *Quercus alba;* Guelph, on *Betula lutea*.

Aspidiotus ulmi, Johnson. On *Ulmus americana*, Guelph, Toronto.

Kermes pubescens, Bogue. On *Quercus alba*, Perth, Toronto, Guelph and Brantford.

Aleyrodes asarumis, Schimer. On *Asarum canadense*, Guelph and London.

Aleyrodes forbesi, Ashm. On *Acer saccharinun*, Guelph.

Mr. W. Metcalfe, of Ottawa, sends the following as the most interesting species he has added to his collection this year:

Ceresa constans, Walk. Hull, Que., very local, but abundant on three special basswood trees. A distinct and readily recognized species.

Pediopsis bifasciata, Van Duzee. Mer Bleue, Ottawa, an Aspen Poplar June. A good species distinct from *trimaculata*, Fitch.

Peltonotellus histrionicus, Stal. Mer Bleue, Ottawa, August. The rare macropterous form of this nearly always wingless species.

Clastoptera proteus, Fitch, subsp. *nigra*, Ball. Mer Bleue, Aug. New to the Ottawa district. (Metcalfe.)

Emesa longipes, DeG. Several specimens of this remarkable bug were found by Mr. W. A. Dent, at Sarnia, Ont., in the first week of October. These are the first specimens which we know of as having been found in Canada. It is an extremely slender species with very long slender legs, the anterior pair of which are modified for grasping. They are called Thread-legged Bugs and are predaceous in their habits. Superficially, they resemble minute walkingstick insects but can of course be seen to be different by their mouth parts and from having wings.

Orthoptera.

Large collections of orthoptera have been made in various parts of Canada during the past two years and many interesting species have been taken. The lists are not as yet complete but some of the more interesting have already been reported on. Most of these specimens have been identified through the kindness of Dr. E. M. Walker, who has also himself collected assiduously. His discoveries have been of so much interest that he purposes at an early date to prepare special papers upon them for the *Canadian Entomologist*. The following captures are worthy of mention:

Mecostethus gracilis, Scudd. On swampy prairie, Radisson, Sask., July 29, (Fletcher).

Aulocara elliotii, Thom. Vernon, B.C., July 26, '95 (Fletcher). The first Canadian record.

Arphia teporata, Scudd. Banff, July 12, '02, (Sanson). New to Canada.

Arphia frigida, Scudd. Aweme, June 21, (Criddle); Radisson, July 29; Rudy, Sask. Red-winged, no yellow costal stripe, July 19, (Fletcher.)

Trimerotropis vinculata, Scudd. Ashcroft, B.C., June 5, (Rev. W. M. Roger). Victoria, (Taylor).

Trimerotropis agrestis, McNeill. Aweme, Aug. 14, (Criddle). New to Canada. This elegant little locust has been taken by the Messrs. Criddle on the sand hills near the Douglas swamp, Manitoba, for many years. In coloration it is exactly like the sand upon which it settles.

Melanoplus altitudinum, Scudd. Fort William, Ont., Aug. 27, Nepigon, Aug. 29. One of the females from Nepigon is a long-winged form. (Walker). New to Canada.

Melanoplus extremus, Walk. A few specimens of the short-winged form were taken in a floating cranberry bog at Go Home, Ont., July to August, 1907. It was common at Fort William where both forms were represented, (Walker); Beaver Lake, Alta., Long-winged, (Halkett).

Melanoplus validus, Scudd. Nelson, B.C., Sept. 30, 1906, (Prof. W. J. Alexander). New to Canada.

Amblycorypha oblongifolia, De G. A beautiful specimen of the pink form of this Katydid was exhibited by Dr. Bethune at the annual meeting of the Entomological Society of Ontario. It was collected at Colchester, South, in Essex Co., Ont., Sept. 30. This form is well shown in *Entomological News* for May, 1901. In *Science* for Nov. 8, 1907, is a note on Pink Katydids and other insects by Mr. J. A. Grossbeck.

Anabrus longipes, Caud. Nelson, Sept. 30, 1906, (Prof. Alexander). New to Canada.

Platycleis fletcheri, Caud. "Four males of this rare insect, hitherto only known by the single female from Calgary, were taken at Fort William. This was one of the dimorphic forms I found in this interesting locality and the only one of that nature known among the Decticinæ. The species is interesting as being of a European type; the genus is a common one in Europe, but is the only one of the *Decticinæ* represented in North America," (Walker); Millarville, Alta., Aug., 1906, 2 short winged males (Dod); Mr. Dod's specimens were taken at about 10 miles from where the type specimen was collected. Although recorded as from Calgary the specimen was actually taken between Midnapore and Millarville, and about 10 miles south of Calgary.

Pezotettix borealis, Scudd. Windy Lake, on C.P.R., near Sudbury, Ont., Oct. 4, three specimens on *Comptonia asplenifolia*, (Fletcher).

Asemoplus nudus, E. Walk. Banff, Alta., (Sanson).

Cyphoderris monstrosa, Uhl. Peachland, B.C., (Wallis). The only previous Canadian record for this rare and grotesque insect was Banff, Alta., where a few specimens have been taken by Mr. Sanson. During the past summer Mr. Wallis collected a pair at Peachland on Okanagan Lake, B.C.

Odonata.

Owing to the encouragement given by Dr. E. M. Walker, of Toronto, several of our collectors have sent in specimens of dragonflies, many of which have already been examined by Dr. Walker. He has provided the following list of species which he considers of more than usual interest to Canadian entomologists:

Lestes disjunctus, Selys. Ottawa, (Létourneau). Metlakatla, Aug. 4, '04. Massett, Q.C.I., (Keen).

Lestes inæqualis, Walsh. Go Home Bay, Ont. One pair from cranberry bog on margin of small lake, July 3, (Walker). New to Canada.

Lestes unguicutalus, Hag. Ottawa, July 16, (Gibson, Létourneau).

Argia violacea, Hag. Hull and Meach Lake, Q., July 13, 21, (Gibson).

Ischnura verticalis, Say. Orange form, Hull, Q., July 17, (Létourneau), Pruinose black form, Hull, July 13, (Gibson).
Nehalennia gracilis, Morse. Go Home Bay. Abundant on sphagnum bogs on the margins of small lakes, (Walker). New to Canada.
Enallagma ebrium, Hag. Ottawa, June 7, July 2, (Gibson).
Enallagma calverti, Morse. Laggan, Alta., 1890, (T. E. Bean).
Enallagma cyathigerum, Charp. One male, Pittsburg Camp, Georgian Bay, June 21, (Walker). New to Ontario.
Enallagma minusculum, Morse. Scotch Lake, N.B., July 7, (W. H. Moore). New to Canada.
Gomphus fraternus, Say. Victoria Harbour, Georgian Bay, July, (A. G. Huntsman).
Boyeria grafiana, Williamson. Nagagami River, Hudson Bay slope, 15 miles up, (Wilson).
Boyeria vinosa, Say. Kenogami River, July 16, '04, (Wilson).
Æschna clepsydra, Say. Ottawa, July 8, (Gibson).
Æschna sitchensis, Hag. Levis, (Fyles). Burroughs Bay, Alaska, Aug. 5, 1894, (J. A. Cadenhead). A rare species recorded also from Newfoundland, *Ent. News*, Apl., 1906, p. 135, by Williamson.
Nasiæschna pentacantha, Rambur. One male, Go Home Bay, Ont., July 16. Also one half-grown nymph from the same locality and several full-grown ones from Bala, Ont., Aug. 28, 1906, (W. H. Fraser). New to Canada.
Didymops transversa, Say. Ottawa, July 14, '99, (Gibson).
Neurocordulia yamaskanensis, Prov. Go Home Bay. Nymphs and perfect insects. June 28 to July 23, (Walker). New to Ontario.
Cordulia shurtleffi, Scud. Nepigon, July 1, '88, (Fletcher). Go Home Bay, July, (Walker). Toronto, June 9, (W. J. Fraser).
Tetragoneuria cynosura semiaquea, Burm. Ottawa, May 31, '99, (Gibson).
Somatochlora forcipata, Scud. Rigaud, Que. (Rev. J. E. Desrochers). Also recorded from Newfoundland by Williamson.
Somatochlora minor, Calvert. Fort William, Ont. Aug. 26, (Walker). New to Canada.
Somatochlora albicincta, Burm. Nepigon, Aug. 30, (Walker). New to Ontario.
Nannothemis bella, Uhler. Go Home Bay. Abundant locally, on floating sphagnum bogs, June 28 to Aug. 1, (Walker).
Leucorhinia proxima, Calvert. Peachland, B.C., July 19, (Wallis).
Sympetrum scoticum, Don. Beaver Lake, Alta., Aug., (Halkett).
Sympetrum obtrusum, Hag. Peachland, July 19, (Wallis).
Libellula incesta, Hag. Go Home Bay, July 15, (Walker).
Libellula exusta, Say. Meach Lake, July 21, (Gibson).

Diptera.

(Arranged according to a Catalogue of North American Diptera by J. M. Aldrich. Smithsonian Misc. Coll. XLVI, No. 1,144. The numbers refer to the pages of the catalogue.)

Aëdes quaylei, D. and K. Nanoose Bay, Vancouver Island, B.C., Aug. 1, (Fletcher).
Aëdes spenceri, Theob. Regina, (Willing).
Culiseta inornatus, Will. Carnduff, Sask., (Willing).
138. *Pelorempis americana*, John. Vancouver, B.C., April 22, (Harvey).
153. *Lasioptera corni*, Felt. Guelph, Muskoka and London, (Jarvis).

155. *Dasyneura canadensis*, Felt. Ottawa, reared from the cones of White Spruce, (Fletcher).
Cecidomyia ulmi, Beuten. Guelph, from *Ulmus americana*, (Jarvis).
Hormomyia cratægifolia, Felt. Guelph, on leaves of *Cratægus*, (Jarvis).

169. *Simulium fulvum*, Coq. Lake Louise, Laggan, Aug. 3, (Skinner and Fletcher).

193. *Pangonia fera*, Will. Crown Mountain, Vancouver, B.C., one male, July 9, (R. S. Sherman).

206. *Tabanus phænops*, O.S. Vancouver, July, a male, (Sherman).

223. *Spogostylum melanopogon*, Big. Crown Mount, Vancouver, July 9, (Harvey). The only locality given in Prof. Aldrich's catalogue is "North America."

241. *Eclimus auratus*, Will. Vancouver, July 25, (Harvey).

272. *Laphria pubescens*, Will. Vancouver, July 25, (Harvey).

401. *Pocota grandis*, Will. Vancouver, July, (Sherman).

418. *Cuterebra frontinella*, Clark. Guelph, larva from neck of kitten, (Jarvis); Almonte, Ont. larva from chipmunk, *Tamias striatus*, (J. K. Darling). The fly emerged at Ottawa in June, (J. F.).

419. *Cuterebra grisea*, Coq. Aweme, (Criddle); Saskatoon, Sask., July 21, (Willing); Norden, Alta., July, (W. Dover).

423. *Alophora magnapennis*, Johnson. One specimen of this grand tachinid was taken at Ottawa by Mr. Harrington. The original type was collected at Montreal by Mr. G. Chagnon. It is easily recognized by its conspicuously large and boldly blotched wings.

449. *Belvosia bifasciata*, Fab. Tessier, Sask. July 20, (Fletcher).

647. *Agromyza æneiventris*, Fallen. Guelph and Muskoka district, on stems of *Populus tremuloides*, (Jarvis).

648. *Agromyza magnicornis*, Loew. Guelph, on leaves of *Iris versicolor*, (Jarvis).

INDEX.

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TORONTO.

To the Honourable JOHN MORISON GIBSON, K.C., LL.D., etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

The undersigned begs to present herewith for the consideration of your Honour the Report of the Entomological Society of Ontario for 1908.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1908.

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Erratum.—On page 54, J. W. Eastham should read A. Eastham.

Thirty-Ninth Annual Report

OF THE

Entomological Society of Ontario,

1908.

To the Honourable James S. Duff, *Minister of Agriculture.*

Sir,—I have the honour to present herewith the Thirty-ninth Annual Report of the Entomological Society of Ontario, which contains the proceedings of the forty-fifth annual meeting of the Society which was held at the Agricultural College, Guelph, on the 5th and 6th of November, 1908. A full account is given of the discussions upon fruit-tree insects that took place, the papers that were read and the reports of the various officers and branches of the Society.

"The Canadian Entomologist," the monthly magazine of the Society, has been regularly issued during the past year and has now completed its fortieth volume. Its high scientific standard has been steadily maintained.

I have the honour to be, Sir,

Your obedient servant,

Charles J. S. Bethune,

Editor.

Ontario Agricultural College,
Guelph.

Entomological Society of Ontario.

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Matthews, J. S	Toronto.
Maughan, J., Jr	Toronto.
McCready, Prof. S. B., O.A.C.	Guelph.
McMillan, G. O	Glenallan.
McRitchie, A. R	Kincardine.
Moore, T. J	Guelph.
Morden, J. A	Hyde Park Corners.
Morris, F. J. A	Port Hope.
Mosey, Miss	Toronto.
Nash, C. W	"
Pearson, Gerald	London.
Readwin, R	Guelph.
Richard, A. E	Ottawa.
Saunders, H. S	Toronto.
Saunders, W. E	London.
Silcox, Sidney	Toronto.
Slater, A. E	Port Hope.
Smith, Arthur	Toronto.
Stafford, E. W., O.A.C	Guelph.
Tanton, John	Kingston.
Thompson, W. Robin, O.A.C	Guelph.
Tothill, J. D., O.A.C	Guelph.
Treherne, R. C., O.A.C	"
Walker, Dr. E. M	Toronto.
Watson, Dr. A. H. R	Port Hope.
Webb, J. H	Toronto.
Wheaton, R. R., O.A.C	Guelph.
White, James	Snelgrove.
Williams, J. B	Toronto.
Wood, S. T	"
Young, C. H	Ottawa.
Zavitz, E. J., O.A.C	Guelph.

Province of Quebec.

Barwick, E. C	Montreal.
Begin, Rev. Abbe, P. A	Sherbrooke.
Bickell, Miss	Quebec.
Boulton, A. R. M	"
Boulton, Capt. J. G	"
Boulton, Mrs	"
Bowen, Miss	"
Brainerd, Dwight	Montreal.
Brainerd, H	"
Burgess, Dr. T. J. W	Verdun.
Campbell, J. G	Magog.
Chagnon, Gustave	Montreal.
Clark, Rev. Wylie, C	Quebec.
Denny, E	Montreal.
Dunlop, G. C	"
Elliott, W. R	Sherbrooke.
Faulconer, Mrs	Levis.
Faulconer, Miss Clare	"
Fosberry, C. S	Montreal.
Freeman, Miss I. H	Quebec.
Fyles, H	Levis.
Fyles, Miss W	"
Fyles, Mrs	"
Fyles, Rev. Dr. T. W	"
Geggie, James	Beauport.
Geggie, Miss Lois	"
Gibb, Lachlan	Montreal.
Griffin, A	"
Hamel, Miss Julia	Levis.
Hedge, Miss Louisa	"
Huard, Rev. Victor	Quebec.
Johnston, Miss M. G	Bedford.
Kollmar, E. J	Montreal.
Lindsay, Col. Crawford	Quebec.
Lochhead, Prof	Macdonald College.
Lyman, H. H	Montreal.
MacLeod, Miss E	Quebec.
Moore, G. A	Montreal.
Norris, A. E	"

CANADIAN MEMBERS—*Continued.*

Poston, Mrs. T. A .... Levis.
Reford, L .... Montreal.
Robertson, Miss............ Quebec.
Seton, Mrs. W. W.......... Levis.
Simmons, J. H .... "
Simmons, Mrs. J. H .... "
Southee, G. R............. Outremont.
Swaine, J. M .... Macdonald College.
Tourchot, A. L .... St. Hyacinthe.
Turnbull, Lt.-Col. F......... Quebec.
Turner, Hon. Richard.... "
Turner, Mrs. R............ "
Wade, Miss................. New Liverpool.
Weir, Douglas .... Montreal.
West, Dr. J................. Magog.
Winfield, Mrs............... Quebec.
Winn, A. F .... Montreal.
Wood, Rev. Edmund........ "

ALBERTA.

Baird, Thos................. High River.
Dod, F. H. Wolley .... Millarville.

BRITISH COLUMBIA.

Abercrombie, Miss Ivy ...... Vancouver.
Anderson, E. M .... Victoria.
Anderson, J. R............ "
Armstrong, E. W........... Salmon Arm.
Bryant, T .... Ladysmith.
Bush, A. H .... Vancouver.
Cockle, J. W .... Kaslo.
Danby, W. H .... Rossland.
Dashwood-Jones, W. H ..... New Westminster.
Day, G. O .... Duncan's Stn.
Draper, R .... Hillcrest.
Elliott, B. R............... Victoria.
English, T. M .... Cowichan Stn.
Foster, F .... Vancouver.
Grassham, R. T............. Keithly Cr'k.
Hanham, A. W .... Duncan's Stn.
Harvey, R. V .... Victoria.
Keen, Rev. J. H............ Metlakatla.
Livingston, C .... Duncan's Stn.
Luscombe, P................ Cowichan Bay.
Marrion, H................. Vancouver.
Mason, J., G.T.P .... Copper River.
Reed, E. Baynes............ Victoria.
Sherman, R. S............. Vancouver.
Skinner, E. M.............. Duncan's St'n.
Taylor, Rev. G. W .... Departure Bay, Nanaimo.
Towler, J.................. Vancouver.
Van Steenweyk, Miss .... "
Venables, E. P .... Vernon.
Wilmot, E. S.............. "
Wilson, T .... Vancouver.

MANITOBA.

Criddle, Norman .... Aweme.
Dennis, A. J .... Miniota.
Heath, E. F .... Cartwright.
Hunter, Rev. A. J.......... Teulon.
Wallis, J. B .... Winnipeg.

NOVA SCOTIA.

Hervey, C. L. G............ Round Hill.
Mackay, Dr. A. H.......... Halifax.
Payne, H. G............... Granville Ferry.
Russell, John.............. Digby.

SASKATCHEWAN.

Croker, A. J............... Redvers.
Willing, T. N.............. Regina.

HONORARY MEMBERS.

Cockerell, Prof. T. D. A .... Boulder, Col.
Cresson, Ezra T............ Philadelphia, Pa.
Edwards, Wm. H .... Coalburgh, W. Va.
Howard, Dr. L. O .... Washington, D.C.
Scudder, Dr. S. H.......... Cambridge, Mass.
Smith, Prof. J. B .... New Brunswick, N.J.
Uhler, P. R .... Baltimore, Md.
Webster, F. M.............. Washington, D.C.
Wickham, Prof. H. F ...... Iowa City, Iowa.

LIFE MEMBER.

Saunders, Dr. William ...... Ottawa.
Director of the Experimental Farms of the Dominion.

Entomological Society of Ontario.

ANNUAL MEETING.

The forty-fifth annual meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, November 5th and 6th, 1908. Owing to the lamented absence of the President, Dr. James Fletcher, in consequence of serious illness, which terminated fatally on the following Sunday, the chair was taken by the Vice-President, Mr. Tennyson D. Jarvis, Lecturer in Entomology and Zoology at the O. A. College. Among those present were Rev. Dr. Fyles, Quebec; Mr. Henry H. Lyman, Montreal; Prof. W. Lochhead, Macdonald College, Ste. Anne de Bellevue; Mr. Arthur Gibson, Central Experimental Farm, Ottawa; Mr. F. J. A. Morris, Trinity College School, Port Hope; Messrs. C. W. Nash, J. B. Williams and Dr. Brodie, Toronto; Mr. Calvert, Orangeville; Mr. Collingwood, Kintore; President Creelman, Professors Zavitz, Hutt, Bethune, Messrs. Howitt, Eastham, Crow, Caesar, Klinck, McMeans and others, Guelph. There were also present a large number of students from the College, and on the Thursday evening of young women students also from the Macdonald Institute. The Society was favored with the presence of Dr. E. P. Felt, of Albany, State Entomologist of New York. Letters expressing regret at their absence were received from Prof. C. C. James, Deputy Minister of Agriculture, Directors C. E. Grant, Orillia; G. E. Fisher, Burlington; and C. H. Young, Ottawa; Dr. E. M. Walker, Toronto; Mr. John D. Evans, Trenton; Mr. A. F. Winn, Montreal; Mr. J. H. Bowman, London, and others.

During the first morning a business meeting of the Council was held at the Wellington Hotel, Guelph, at which their report was drawn up, and various matters discussed. It was decided to permit the formation of Nature Study Clubs in affiliation with the Society at any school in the Province on condition that there should be at least six members and that each Club should pay one dollar a year as a subscription to the funds of the Society; in return each Club should receive one copy of the issues of the "Canadian Entomologist" and a copy of the Annual Report for each individual member. The Society would also endeavour, on request, to send a representative to deliver a lecture on some natural history subject once a year if practicable. The following resolution of sympathy with Dr. Fletcher in his illness was adopted and a copy was sent to Mrs. Fletcher in order that it might be communicated to him.

"The members of the Entomological Society of Ontario have heard with deep regret of the serious illness of their esteemed President, Dr. James Fletcher, and of his enforced absence from this annual meeting.

"They desire to convey to Dr. Fletcher their earnest hope that his illness will be of no long duration and that he may soon be restored to health and strength. They beg to assure him of their warm sympathy with him in his sufferings and the interruption to his useful work."

The afternoon meeting was held in the spacious Massey Hall at the College and was largely attended. Mr. Jarvis took the chair at 2 o'clock and called upon the Directors of the Society to read their reports on the noteworthy insects of the year in their respective divisions. Mr. Fisher sent a letter explaining his inability to prepare a report for Division No. 5 owing to the pressure of business, and there was no report from No. 6 in consequence of the lamented death of the Director, Mr. J. A. Balkwill, which took place at London on October 10th.

REPORTS ON INSECTS OF THE YEAR.

Division No. 2.—Midland District. By C. E. Grant, Orillia.

The season of 1908 was a beautiful one, the finest summer I think I ever saw, but still there was no great outbreak of injurious insects and in fact no insects were particularly abundant as noted by me. On account of the small amount of rain in this section the plant lice were rather plentiful; I saw a field of turnips in September which were practically covered with them, but still the turnips were above the average size and the owner of the farm stated that he had taken no measures to kill them off.

Another insect, the yellow-necked apple-tree caterpillar, (*Datana ministra*) was remarkably abundant, some apple trees were nearly stripped of their leaves in the gardens around the town and the moths came in droves to my lamp.

The Buffalo beetle nuisance seems to be increasing, nearly all housewives are complaining of it and it seems hard to devise a perfect remedy for it.

Heliothis armiger is another insect which has been complained of as affecting the corn; the moths were flying in the day time over a clover field I visited in September and October along with *Plusia brassicæ*; I took both species in numbers; there had been corn grown in the next field.

This season I purchased a 7 amp. multiple lamp and had it installed on my verandah, the results were wonderful as to the number of insects attracted; the bombardment of *Lachnosterna fusca*, June beetles, in the spring was more than anyone but an Entomologist could stand and every now and then the deeper hum of *Belostoma americana*, the giant water-bug, would be heard, as this great bug thumped down on the verandah; during the month of June there was a constant and ever-changing stream of insect life. Unfortunately our power had to be shut down from the middle of July to the end of August, thus spoiling my sport. I got, however, several good things such as *Caripeta discivaria, Syneda Alleni, Apatela quadrata,* two new Plusias, *Oreta rosea,* and five or six *Eacles imperialis.* I took twelve species of Hawkmoth, the rarest here being *Smerinthus myops cerisyii* and *Sphinx luscitiosa;* one very handsome *Heterocampa* was also taken, if not *astarte*, it is very much like it. A new *Crocota* and several good things not, however, new to me such as *Mamestra nimbosa* and *latex,* and others too numerous to mention. If I had been present at the meeting I should have liked to have given a longer account of the numerous species attracted but as the directors are supposed to confine their report to injurious insects I will at some other time give a fuller list of what can be taken at Orillia, if it is thought desirable. I might mention one other capture in the daytime, namely, *Anisota virginiensis* (or *stigma*) taken on the edge of a wood flying about ten feet from the ground in the bright sunshine. *Junonia cœnia* was rather plentiful; I took four specimens in two weeks, *Colias eurytheme* was also taken several times.

Division No. 3—Toronto District. By J. B. Williams.

I am not able to report very much this season as I was away in England most of the summer.

The Tussock Moth did a good deal of damage to the shade trees in Toronto. I noticed, in September, that a large part of many trees had been nearly stripped of their foliage. The late Park Commissioner, Mr. Chambers, always said that in many streets it was almost useless collecting

cocoons because in adjoining private grounds the trees were infested with them, and the owners took no trouble to check their increase.

Our new Commissioner, Mr. Wilson, is getting a by-law passed to enable him to collect the cocoons on private grounds, as well as on the streets, and he has a grant of $5,000 for the work this winter; so we may expect to see some decided improvement in a year or two, if the work is thoroughly carried out.

Last year there was an almost total absence of Walking Stick Insects *(Diapheromera femorata)*, in Niagara Glen, but this year they again appeared in countless hosts; some trees were quite stripped of their foliage by them, and they kept falling in numbers on the heads and shoulders of any passers-by in parts of the Glen where they were most numerous. Probably the cold weather in May and June last year prevented the eggs from hatching, and so they all lay over until the second year, as they are sometimes known to do, and then produced an especially numerous and voracious crop of Walking-sticks.

DIVISION NO. 4—EAST YORK DISTRICT. BY C. W. NASH, TORONTO.

In April last I attended two meetings of Horticulturists at Oakville. At these meetings the insect pests which infested the orchards of the vicinity were thoroughly discussed. Among those mentioned as being particularly destructive was the Tree Cricket. This insect is now very abundant in raspberry plantations and was said to do more harm in that locality than any other pest they had. Raspberry growers in other districts should be on their guard against this Cricket for where it becomes established it is somewhat difficult to control and it is capable of doing much mischief.

Although the early spring was cold and apparently unfavorable to insect life yet, when on April 12th I was cleaning up my garden, I found that under the shelter of the dead leaves which laid thickly over the flower beds, many forms were snugly and safely tucked away, waiting for warmth and sunshine to start them upon their summer activities. At the base of some of my shrubs small adult Lady beetles were very abundant; these I was not surprised to find, for like many others of their order, they hibernate in the adult stage, but when clearing up some hardy carnation plants, I was not only surprised but somewhat disgusted at finding upon them a large number of nearly full grown wingless green Aphids. That many species of Aphids hatch early and grow rapidly, I am well aware but this was the first time I had ever seen lively well-grown specimens flourishing when surrounded with ice crystals, upon plants which were still saturated with water from melting snow.

On May 5th from beneath a heap of dead leaves I raked out a handsome Red Admiral butterfly. It was living but very listless and weak.

Although for several years I have kept a sharp lookout, east of Toronto, for the Red Asparagus beetle I did not find it. This year, however, it appeared and by the end of the season outnumbered in some places the common Blue species. Both forms were abundant on the plants at the same time. The Red is much the more active of the two, flying off instantly when an attempt is made to capture it.

The Hunting Beetles *(Calosoma)* appeared to be much more abundant this year than usual, *C. calidum* especially being particularly common about the end of June.

Cosmopepla carnifex, which for the past three years had been steadily increasing in number, was entirely absent; I did not see one anywhere during the whole season. The Rose Beetle, too, has disappeared. This I can

account for as the sparrows hunt for them most persistently and feed them to their young when in the nest. It may be that they also feed upon Cosmopepla but I have seen no evidence of it.

The Monarch butterfly did not make its appearance this year in this district until late. On July 8th I saw the first, a single one, very much worn and dull colored. On the 11th I counted about a dozen between Toronto and Highland Creek, a distance of sixteen miles; these were old and much worn. On the 20th of August new, fresh specimens were common and soon were mated.

Usually the migration of this species is at its height during the first week in September, after which but few stragglers are seen. This year I saw no migration in large flocks at all and stragglers were fairly common as late as the first of October, and the last was seen on the fifth.

House-flies have been comparatively scarce this summer and so were Mosquitoes until the evening of July 8th when they became fairly abundant, but at no time during the season have they swarmed in their usual hosts. Most of those examined were parasitized by mites, but this does not prevent their doing business in their good old fashioned way.

The Stalk borer (*Gortyna cataphracta*) was more abundant and destructive than ever before. This year I found the first young larva in the blossom stem of an Iris on the 15th of June. The larva was rather less than a quarter of an inch long and had evidently entered by boring a hole from the outside at about nine inches from the ground. As in 1907 I gave the full life history of this pest as far as I know it, I need not repeat it. No parasites have yet been bred by me from the larvæ of this moth, though I have carried a great many of them through to the imago stage.

While *Gortyna cataphracta* is a much dreaded pest in a flower garden, yet the damage it does rarely extends to the entire destruction of a plant; the affected stems are killed but the root is uninjured. All members of the genus are not, however, so considerate, for some of them work into the root-crown or the roots and thereby cause the death of the plant affected.

This summer I noticed that all my plants of *Aquilegia chrysantha* looked sickly and they scarcely threw out a healthy blossom. On August 20th the plants appeared to be dead. Upon pulling away the stalks which came off easily, the upper part of the fleshy roots was found to be hollowed out. A search in the soil yielded two chrysalids; they were lying about four inches from the roots and about two inches beneath the surface of the earth. These I took in and from them, on the 5th and 8th of September, moths emerged which are, I believe, *Gortyna purpurifascia*. One of them, shortly after emerging, deposited a number of eggs singly upon the surface of the soil in the jar where the moths were bred out.

If this moth becomes common, Aquilegia growers will require to look out for its larvæ or they will lose their plants. Strange to say while all my *chrsanthas* were destroyed, no other variety of Aquilegia was attacked.

Although I have grown Aquilegias for many years in Ontario, I have never before had one attacked by this insect nor have I ever seen any others so affected in this district.

I am sorry to say that at last I have positive proof that the San José scale has become established on the north shore of Lake Ontario. As yet, however, there are only two or three orchards infested, but past experience has shown that unless proper precautions are taken the pest will rapidly spread.

This year the Tussock Moth larvæ were about as abundant as usual. On the 13th of July I saw many spinning cocoons, at the same time there

were numbers of them not more than a quarter of an inch long. Could the cold backward season have delayed the hatching of the eggs in some cases?

Although I have since 1887 paid a good deal of attention to this insect and each year have bred large numbers of them I had found but few parasitized. This season, however, in some parts of the City of Toronto it was the exception to find a pupa free from parasites, the chief of these being *Pimpla inquisitor*. As I have brought a number of specimens of the various parasites bred from the Tussock Moth larvæ which we can discuss at leisure, I need make no further reference to them now.

THE WHITE-MARKED TUSSOCK MOTH.

By Paul Hahn, Toronto.

Being asked by our President, Dr. Fletcher, to deliver a report regarding the extermination in Toronto of the white-marked Tussock Moth (*Hemerocampa leucostigma*), which has done so much damage to our shade trees, allow me to state the following. (Fig. 1.)

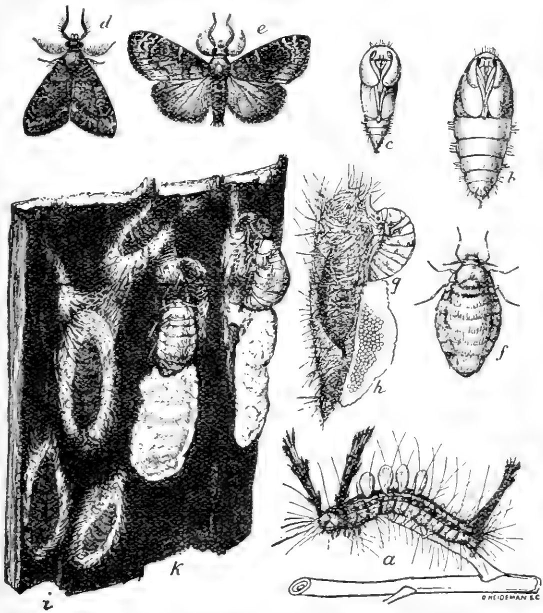


Fig. 1. Tussock Moth: *a* caterpillar; *b* and *c* chrysalids; *d* and *e* male moths; *f* and *g* wingless female moths; *h* eggs; *i* male cocoons; *k* female moths and egg masses on cocoons.

Two years ago noticing that this insect had done considerable harm to our beautiful trees I called on the Mayor and the Park Commissioner of our city.

I advised them strongly to collect the egg-masses and urged them to get a special permit from the Government to pass a by-law compelling citizens to rid their trees of these egg-masses.

Very soon after this visit I took ill and was unable to follow up the matter, having to go out of town for quite a long time. Last year I thought again about taking up the matter, but being still in poor health I had to abandon the idea.

I made out a report, called on the Board of Control, and bringing the matter up most forcibly at their meeting I persuaded them to give the Park Commissioner a grant of $5,000 to enable him to clean the city trees of these egg-masses, at the same time urging the passing of the by-law compelling the citizens to clean their trees.

On receipt of the grant of $5,000 the Park Commissioner at once sent out several gangs of men and they did splendid work in the infested places.

About October 1st the by-law was passed and it was published in all the papers, giving the citizens ten days' notice to have their trees cleaned. Should the property holders not comply with this request the city has full power to enter upon the premises, do the work and charge it up to the citizens. This charge to be levied and collected with the local improvement rates for the current year or other municipal rates.

Should it be necessary the Park Commissioner will engage the school-children again to collect the caterpillars and give them so much per quart, and if needed some spraying will also be done.

With the above method I feel sure the pest will be wiped out.

Dr. Bethune expressed his gratification at the success which Mr. Hahn had achieved in at length persuading the Board of Control in Toronto to adopt proper methods of dealing with the Tussock Moth trouble. It was a disgrace to the city that this insect should have been permitted for so many years to ravage the horse chestnut and other shade trees; the failure to deal properly with the pest was due to the late Park Superintendent who would not take the advice of Entomologists but adopted methods of his own, which were perfectly useless.

Mr. Nash: I have this to say that I think the whole trouble in Toronto may be very fairly charged to the late Park Superintendent. It was in 1887 that I first noticed the Tussock Moth in Toronto, and I called his attention to the fact, and he then gave me to understand that he knew all about it, that he required no advice nor assistance, and that he would do as he pleased in the matter. I think about the same time I spoke to Dr. Brodie and he said that he and other members had endeavoured to do something and that they had failed. However, from that time on the Tussock Moth increased. Application was then made for funds and every year he has been supplied with three or four thousand dollars. He could have used that money to very good advantage, but as a rule it was simply thrown away. They waited until the larvæ were about to spin their cocoons and he then expected to kill the insects by putting poisons on the foliage long after the caterpillars had ceased to eat. However, we have now a thoroughly educated man in charge of our parks, one capable of judging and observing for himself and willing also to take the advice of those who are experienced. It is not possible for us now to exterminate the Tussock Moth; it has spread all through the woods and is all over the country. I found it on Manitoulin Island and on St. Joseph's Island where it had done an immense amount of mischief. As everyone knows the egg-masses must be destroyed and this can very easily be done during the winter months.

CONFERENCE ON THE CHIEF INSECT PESTS OF THE SEASON.

THE LEAF BLISTER MITE.

The Chairman, Mr. T. D. JARVIS, announced that the rest of the afternoon would be devoted to a discussion of some of the chief insect pests of the season, taking up especially those injurious to fruit culture. The first to which he would draw the attention of the meeting was the Leaf Blister Mite (*Eriophyes pyri*) which attacks the foliage of the pear and apple, and has during late years slowly and steadily spread throughout Ontario. It is an almost microscopical mite and by its attacks causes little blisters to appear which become dark brown on the under side of the leaves.

Mr. CAESAR showed some mounted specimens of the Blister Mite and stated that they are to be found on the under side of pear and apple leaves on which they produce dark swellings which look like a fungus disease. In travelling through the province this year he had found this Blister Mite in the Niagara district, at St. Catharines, Grimsby and other places; also in Essex county, some in Norfolk, a great deal in Prince Edward county, a considerable amount in Peel county. In his own home orchard in Peel county were some pear trees that had hardly a single leaf that was not covered with the work of the Mite. A year ago here at the College he found it in the orchard on the pears, but this year he could not find any. The only explanation that he knew of for its disappearance in the orchard was that the trees had been sprayed with lime-sulphur. It is found that this Blister Mite winters over in the nearly full grown stage. It is such a tiny little animal that it can hardly be seen with the naked eye. Before winter comes on it gets under the scales of the buds where the lime-sulphur wash may reach and destroy it. There is also another remedy that has given good results for the destruction of this pest, viz.: kerosene emulsion. Mr. Caesar did not know how injurious the pest might be, but from the diseased trees which he had seen, it must do a great deal of damage by lessening the power of the tree to supply food for its necessary growth.

Mr. JARVIS: It is interesting to hear that the lime-sulphur wash may destroy this pest. A species of this genus of mite with similar habits attacks perhaps forty or fifty of our forest and shade trees, and if the lime-sulphur will kill them, it will be a good remedy for the Soft Maple mite as well as many others which winter in the leaf buds.

Dr. FELT: The Blister Mite, in some parts of New York state has been very injurious. I noticed one place in particular where some trees were so badly infested by Blister Mites that one could see the brown foliage a quarter of a mile away, and when the foliage is in that condition there is no doubt that the trees are seriously injured. Our experiments go far to show that lime-sulphur or an application of miscible oils or kerosene emulsion in early spring is very effective in controlling the mites.

Respecting the value of the lime-sulphur wash on Maple trees it would depend on whether it would go under the bud scales and thus destroy the mites; he was doubtful whether it would do so.

Mr. JARVIS: I have had no experience with the lime-sulphur on these trees; I only suggested its use, but as Dr. Felt implies the scales of the Maple buds are very compact and perhaps the wash would not get into them so well as it would those that are looser.

Mr. CAESAR wished to know whether the wash had ever been applied in the fall instead of the spring with the same good results.

Dr. Felt: I see no reason why the application would not be just as successful. In the case of the San José scale we do not hesitate to recommend the use of the lime-sulphur in the fall; I think the same would be true in the case of mites, but I would much prefer to advise putting it on in the spring. If the operations are delayed a little the buds will be slightly opened and you will secure greater results in that way. The material retains more or less its caustic value for a considerable period and the wash will, therefore, prove destructive to any mites which it reaches.

The Lesser Apple Worm (*Enarmonia prunivora*).

Mr. Jarvis: There is considerable interest being taken in the so-called work of the Lesser Apple Worm this season and I shall ask Mr. Caesar to introduce the subject.

Mr. Caesar exhibited a number of apples that had recently been sent to him from Prince Edward county and from St. Catharines. The senders believed that the injuries were due to some new worm. Mr. Caesar said that all he knew about this pest was what Professor Quaintance had described in his bulletin on the subject but that he was very anxious to get any information that any of the entomologists present could give him. He felt that the injuries on some five or six apples which he picked out corresponded very closely with Prof. Quaintance's descriptions and illustrations. On showing these to Dr. Felt the latter agreed with him that they were probably due to the Lesser Apple Worm. The other injuries Dr. Felt and others thought were not caused by this insect. Mr. Caesar said that if the first class of injury pointed out was due to the Lesser Apple Worm, it would appear that this insect was to be found throughout a large proportion of the best orchards of the province but that it was satisfactory to find that nowhere was it abundant. It was not an entirely new pest because Dr. Fletcher had reported its presence at Toronto, Prince Edward county and Ottawa several years ago. It is also very widely spread throughout British Columbia but Mr. Palmer, one of the Agricultural College students and a son of the Mr. Palmer who has furnished Dr. Fletcher with reports of its progress in the West, states that it is not increasing rapidly in British Columbia.

The life-history of the insect is very similar to that of the Codling Worm but, unlike the latter, instead of boring a hole into the core of the apple it lives near the surface, often causing ugly blotched mines either on the side or at the calyx end. These blotches are often as large as a ten cent piece, or even larger, and disfigure the apple greatly. It is believed that the spraying that controls the Codling Worm will also control the Lesser Apple Worm.

Prof. Lochhead: I have not observed its work at all in the Montreal district. The only reference to it I have had came from Kingston, so I have have had no experience in dealing with it. I do not think it has been reported from Quebec province.

Mr. Jarvis: It is so much like the Codling Worm that we may easily pass it by and not recognize it.

Dr. Felt: I wish to say that I have had no experience with the Lesser Apple Worm. We know, however, that the Codling Worm goes deeper into the apple, so it appears as though the apples exhibited may in some cases have been attacked by this less common pest. The only way, I think, that we can be absolutely certain about it is to find some of the larvæ at work. Although the larva of this insect is very like that of the Codling Moth, yet on careful comparison you can see a difference, particularly, if I remember correctly, at the posterior extremity.

The Apple Maggot (*Rhagoletis pomonella*).

Mr. Jarvis: The Apple Maggot is the larva of a little two-winged fly, and it is reported from a few places in Eastern Ontario. I should like to know if it has spread to any other districts.

Prof. Lochhead: We found the Apple Maggot somewhat abundant in certain districts about Montreal. A few miles up the Ottawa River the Apple Maggot has been abundant for some years in a large commercial orchard and the owner has done everything in his power to control it. Just across the river from Como there is a farm where the Apple Maggot is known to be and we have two careful observers there, upon whose observatios I think we can depend. At St. Anne's, five miles from there, I have found the Apple Maggot in some of the old orchards on French farms. I have not observed it on the College trees. Then at Hull, further west, Mr. Reid, Secretary of the Quebec Horticultural Society, reports its presence; and at Covey Hill, near the boundary line between Quebec and New York. I have not seen it there myself. Mr. Swaine was in that district and he confirms Mr. Reid's observations. Then in the City of Montreal one of this College's graduates, who is in charge of the work this year, reports the Apple Maggot as doing serious damage. It is in the barrels in which the apples are packed for shipping. Sometimes he finds it hard to detect. The Apple Maggot, of course, works underneath the skin of the fruit and seldom comes close to the surface. It is difficult to tell when an apple contains one of these maggots. (Fig. 2.)

The only method that we can recommend for its destruction is clean culture and gathering and destroying all the apples that fall. It seems that the Apple Maggot does not leave the apple until full grown. As soon as the apple falls the maggot matures, crawls out and hides at or near the surface of the ground, and there pupates.

Now, it is thought that if hogs or sheep or any common stock are allowed in the orchard to pick up and destroy this fallen fruit the pest would be unable to develop and to pupate. I think that this is probably one of the best methods; but then again we have the point: no matter how careful we are, suppose our neighbors do not take steps for their control, would not the apple flies come over to us from our neighbors? It has been asserted that the flies are not given to the habit of flying from orchard to orchard but confine themselves to the same trees. I do not know how far that can be confirmed.

Going through Prince Edward county six or seven years ago I estimated that from one-third to one-half of the apples were damaged by the Apple Maggot. It does not seem to spread very far out of that particular district. It just seems to locate in certain parts and is not widely spread.

Mr. Gibson: We have had reports from Ontario and Prince Edward counties regarding it this summer.

Mr. Caesar thought the fly did not migrate as a rule. He had found in Prince Edward county a Snow apple tree which had been badly affected by the maggot for three years, while the fruit on the other trees near by of the same variety was untouched. Tolman Sweets were attacked, but Spys and some others in the same orchard were not; Crab apples were also severely injured. It seems on the whole as if the insect preferred the early varieties. The fruit-buyers have now become sufficiently familiar with the pest to refuse to purchase fruit affected by the maggot; such fruit is only fit for the cider mill. Mr. Caesar did not mean to imply that winter apples were not attacked because in other orchards than the one referred to he found

Spy apples very badly affected. While in Prince Edward county he had met one man who had succeeded in almost completely destroying the insects by careful attention to fallen fruit. Hogs had been of great service in accomplishing this result.

Mr. JARVIS: While there is no doubt that the Apple Maggot attacks winter apples, yet my experience has been that it prefers Yellow Harvests to any other variety. I also find it in fall apples.

MALFORMATIONS OF FRUIT DUE TO INSECTS.

Mr. JARVIS: We should, I believe, now discuss another question that has interested us a good deal this year, viz: the cause of malformations of apples and pears. I hope anyone who has had any experience and has studied them will speak out and help in the discussion.

Mr. CAESAR: Here is an apple that was sent in by Mr. Sweny, son of Colonel Sweny, of Toronto, from British Columbia, to find out what was wrong with it. You will notice that there are several strangely elevated areas on its surface suggestive of the boils that rise on a person's body, if I may be allowed to use the comparison. There are also several rather deep depressions. The sender said that whole orchards last year and this year were affected in this way. He said that this year his neighbors had carefully drenched their trees with Bordeaux in the hope of getting free of the trouble. He had used lime-sulphur on his orchard. The result had been that his orchard, with the exception of some of his Duchess trees was very little affected, while his neighbors have had poor results from their spraying. I have very little idea as to what has produced this malformation that you see. Mr. Sweny says: "On Spys, Duchess, Wealthy and Ben Davis, the injury appears chiefly as a hollow, usually turning brown, with a dry brown spot running to the core. On peaches the appearance is the same, but the flesh is not affected." The specimen I have shown you is, he thinks, another form of the same trouble. If he is right in his belief that lime-sulphur has saved many of his apples this year it would, I think, stand to reason that the insect (for there is not much doubt that it is an insect) hibernates in some form on the tree and so is destroyed by contact with the wash. Bordeaux of course would not be expected to give good results against an insect.

There have been a number of pears and a few apples sent to us this year from Brooksdale and Bowmanville, Ontario. These were badly distorted by depressions and elevations. It looks very much as though the trouble is due to the punctures of some insect. When over in the State of New York this autumn I found similarly misshapen apples and asked the entomologist at Geneva what he thought was the cause. He said he had always attributed it to the Plum Curculio. A few days afterwards I showed the same fruit to Prof. Slingerland, who thought that it was not the Curculio but some species of Hemipterous Leaf Bug that had caused the injury.

Dr. Fletcher also thought the injury was due to some Hemipterous insect, possibly a Jassid (Leaf Hopper). I hope some one here has had some experience that will throw further light on this important matter.

No one present had devoted sufficient time to the subject to feel able to give any further suggestions. It was pretty unanimously agreed, however, that the injury was due to some species of insect.

After this specimens of the undoubted work of the Plum Curculio on apples were shown.

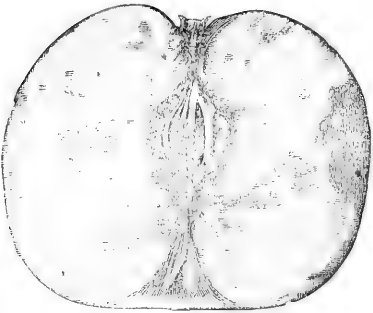


FIG. 2.. Apple affected by Apple Maggot.

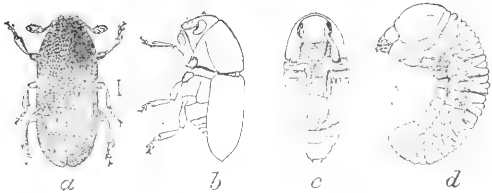


FIG. 3.—*Scolytus rugulosus*: *a*, adult beetle; *b*, same in profile; *c*, pupa; *d*, larva—all magnified about 10 times. (U. S. Dep't. of Agriculture).

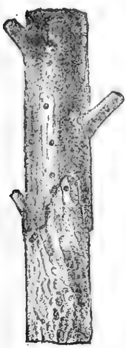


FIG. 4.—Work of *Scolytus rugulosus* in twig of apple—natural size. (U. S. Dep't. of Agriculture).

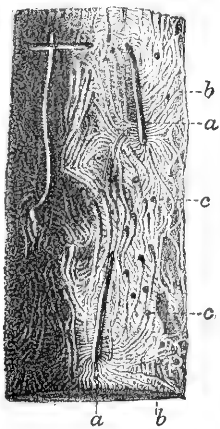


FIG. 5—Galleries of *Scolytus rugulosus* on twig under bark; *a*, *a*, main galleries; *b*, *b*, side or larval galleries; *c*, *c*, pupal cells—natural size—(after Ratzeburg, from U. S. Dep't. of Agriculture).

The Shot-hole Borer (*Scolytus rugulosus*).

Mr. Jarvis: The Shot-hole Borer or Engraver-beetle has been doing considerable injury, or at least we think it has been doing so, during the past two or three years. At one time it was thought that the borer only worked on decaying wood or on unhealthy trees, but some of our fruit-growers are beginning to think that they cause the death of the tree. We would like to hear from any of the members who have had any experience with this beetle.

Mr. Caesar: The Shot-hole Borer was brought up and discussed last year at the annual meeting of the Entomological Society. We had hoped that its ravages would be checked by this year, but it has been so destructive this spring and fall that it is necessary, in justice to the Society, I think, and in justice to those who are interested in the work of the Society, that it should be brought to the attention of the members.

When I was down near St. Catharines on the 10th of June examining a fungus disease that was attacking the peach trees, Mr. McCalla—one of our best and most scientific fruit-growers,—asked me to come and look at his cherry trees. He had fifteen fine sour cherry trees apparently flourishing so far as the foliage showed at that time, but every branch up to half an inch in diameter was practically covered with exudations of gum. There were thousands of exudations on the trunks and all over the trees. Of course a tree cannot stand that sort of thing very long. On removing the gum with a knife one could see a little round hole quite clearly. A black beetle about a quarter of an inch in length was causing the trouble. Last year I found in about ten different districts perfectly healthy trees, both sour and sweet cherry, attacked by this same Shot-hole Borer, (*Scolytus rugulosus*). Figs. 3, 4, and 5.

Not more than two weeks ago a man near Grimsby, to whom I had recommended a method of treatment last year, wrote me that he had again this fall millions of these beetles. "I believe," he said, "it is the most difficult pest there is in the Province to combat. I have already this fall removed sixty of my cherry trees out of three hundred. I have taken out twenty loads of branches in addition and I am afraid I am going to lose every cherry tree I have got."

Just the other day I had a letter from Mr. Beattie, of St. Catharines, stating that his peach trees were being severely attacked. I have often seen a peach tree here and there throughout the district attacked but the sweet and sour cherry trees are by far the most commonly assailed, occasionally plum trees are rather badly attacked.

Dr. Felt: You have found that they attack the healthy cherry trees as well as diseased ones?

Mr. Caesar: Yes, the fifteen cherry trees belonging to Mr. McCalla gave every appearance of being perfectly healthy when attacked. Many of the trees I found attacked last autumn were also healthy ones.

Dr. Felt: Is it not probable that there is a great deal of dying wood in that district?

Mr. Caesar: There is a great deal of it. I am afraid that unless old orchards that have been killed by San José scale or trees that have died from other causes are cut down and burned, these may afford such excellent breeding grounds for the beetles that the fruit-growers may lose very seriously from the attacks of great numbers of them on healthy trees. The beetles certainly are increasing at an alarming rate.

My observations this year and last year lead me to believe that there are two periods in the year when they are specially destructive: First, in May, continuing on for some time into June; second, in August, continuing on through September. I might say that in no case hitherto have I been able to find either eggs or larvæ under a gum mass on a healthy tree; so that it would seem perfectly possible in many instances to save healthy trees even after they are attacked. If there were eggs or larvæ under the gum masses this would be impossible.

The treatment recommended last autumn in a circular letter to the press of the district was to cut down and *burn* before the warm days of the spring all dead and dying trees, and also any trees so badly weakened that there was small hope of their recovery. In addition, dead or badly attacked branches were to be pruned off and burned. This was to be followed by the thorough spraying of all the remaining trees with lime-sulphur in the spring. This was done in several orchards and no further trouble was found, or in those orchards where spring applications of an oil wash had been made. This is not sufficient, however, to prove that lime-sulphur or an oil wash, such as Carlson's Mixture, was the real cause of the absence of the beetles, though it looks as though such was the case. For the August attacks it seems probable that lime-sulphur or a lime and soap wash with a little carbolic acid in it would be very useful as a means of warding off the beetles.

Prof. Lochhead: I remember that some years ago when dealing with the San José scale this Shot-hole Borer was very abundant in some districts where the scale had already killed the trees. I have always believed that the Borer attacked trees that were a little off-color or something wrong with their roots, and so not completely healthy. I do not see exactly why the borers should limit themselves to diseased trees; still it seems to be their natural habit to go to such trees.

Mr. Jarvis: I know of three peach trees in sod in the Grimsby district which are badly attacked by this beetle; close by there are other trees where the soil is cultivated, which show no evidence of this pest.

Dr. Felt: I have watched these insects for some years and know that generally speaking they do attack weakened or diseased trees. I believe, however, that they do, as mentioned this afternoon, sometimes attack perfectly healthy trees. The real source of the trouble in such cases is not necessarily due to their breeding in the immediate neighborhood. Dr. Hopkins has recorded flights of the beetles evidently coming from a considerable distance and I believe that they fly in more or less large swarms. My impression is that the beetles that have attacked the healthy trees referred to have probably come in swarms of greater of less extent. I think the only practical solution of the difficulty is to get the fruit-growers interested and remove all the dead material. Then let them, as suggested, put on their lime-sulphur. If it does not ward off the beetles it will at least pay for itself by warding off fungus diseases.

In answer to the question whether he agreed with the statement that there were apparently two main times in the season that attacks were to be feared, Dr. Felt said he believed the statement was correct so far as he knew.

Aphids.

Mr. Jarvis: The cabbage Aphids have been increasing year after year now for several years. We get a great many letters asking for remedies. We find it very difficult to get any really satisfactory remedy that seems practicable.

Mr. CAESAR said he was afraid that no remedy could possibly ward off attacks because he thought that winged females flew from plot to plot and rendered all remedies more or less futile.

Mr. BETHUNE: I think that it is the long continued dry weather that has allowed the Aphids to become so very numerous and destructive this year. It is very difficult to suggest a remedy to a farmer who is growing turnips by the acre, because he will not apply a troublesome spray, and what I recommend them all to do is to be on the lookout when they are hoeing the crop and trample underfoot any affected foliage. Some farmers said that their crops were entirely destroyed, while others said that the turnips were all right though the foliage was very badly affected.

Another insect which has been serious in a great many places is the Turnip Maggot, similar to the Cabbage Maggot. These insects cause the turnips to be all distorted and with woody or rotten spots. They are then useless for any purpose as the cattle will not eat them and they are of no use in any other way. I do not know any remedy that is really practicable for dealing with this insect.

THE BAG WORM.

Mr. JARVIS: I wish to call your attention to another insect that was found by Raymond Zavitz, of Guelph, this year, the Bag Worm. It was found on a cherry tree. I think it has been found here for the first time. I would like to hear what Dr. Felt says about this pest. We have it here this year and it is probably the first time that it has been reported in the Province. I saw a note about its being found in New York State.

Dr. FELT: The Bag Worm is in New York State, rather commonly about New York City, and I should say off and on ranging rather abundantly for thirty miles around. This last summer I was rather surprised to receive the Bag Worm from Red Cedar, forty miles south of Albany. I think it is an unusual record for New York State and just why you should find the insect here I do not understand, because this must be equivalent to about fifty miles further north than the latitude of Albany, and perhaps the weather is a little more extreme in winter.

Dr. BETHUNE: I had a specimen of the moth given to me two years ago, which was taken in this part of Ontario and I thought it was extremely remarkable. I never heard of the Bag Worms in Ontario before. Here in Guelph we are just on the verge of the upper Austral and the Canadian Boreal zones and we get a little of the fauna and flora of both zones, so that we find a few insects reach us here that hardly extend further north or south, as the case may be, and it seems we are free from most of the southern species which are troublesome along the shores of Lake Erie. This insect certainly is remarkable for having come to such a point as this.

As far as these zones are concerned I suppose we are rather more than fifty miles further north than Albany. It is never safe to say where the line between these zones should be drawn.

We find many things growing quite luxuriantly about Dundas and in the vicinity of Hamilton, which will not grow here at all. We are, I think, about 1,100 feet above the level of the sea and are more than twice as high above Lake Ontario as the Hamilton Mountain, so that there is a difference in altitude as well.

After some further informal discussion on a variety of injurious insects, the meeeting adjourned.

EVENING SESSION—THURSDAY, NOVEMBER 5TH, 1908.

A public meeting was held in the Massey Hall building of the Ontario Agricultural College, and was largely attended by members of the Society, students of the College and Macdonald Institute and visitors from the city. The chair was taken by Dr. Bethune, Professor of Entomology. The proceedings were very much enlivened by musical selections excellently rendered by the College Orchestra.

The chairman, in his opening remarks, referred in feeling terms to the great regret that was felt by all at the absence of their President, Dr. James Fletcher, who was seriously ill in a hospital at Montreal. Being the forty-fifth annual meeting of the Society, of which he, the chairman, was one of the founders, he gave a short account of the history of the Society and of the good work which it has accomplished during all these years. He then introduced, as the chief speaker of the evening, Dr. E. P. Felt, of Albany, the State Entomologist of New York, who was widely known from the numerous books and papers on economic and systematic entomology that he had published; though still a young man he had attained a high reputation due to the excellence and thoroughness of his work. Dr. Felt then gave the following lecture on "The Interpretation of Nature," which was illustrated with a large number of beautiful and interesting lantern slides.

THE INTERPRETATION OF NATURE.

BY E. P. FELT, ALBANY, N.Y.

Our civilization is based on the accumulated wisdom of the ages. The ancient lore of the Chinese, the mystery of the Hindoo, and the culture of the Greek, all have had an important influence upon the development of the human race. The learned man acknowledges his debt to these and other sources of wisdom. None take issue with Pope when he writes: "The proper study of mankind is man." We would go farther and say: The proper study of mankind is man, the earth and the fulness thereof. Even as ignorance of the wisdom of the ancients restricts the usefulness and activity of the individual, so does a failure to understand the laws governing the existence of other forms of life, circumscribe the power of dominant man. In other words, the welfare of man is most closely bound up with that of a number of animals and plants. Detailed knowledge of these latter is essential to continued progress. One can not be separated from the other.

Nature is kind to the student of economic entomology, since she gives him five or six opportunities to identify an insect, namely, the egg, larva, pupa, adult and work. This kindness is not always so apparent, especially when it is remembered that this abundance and variety of form means a corresponding increase in the number of characters to be memorized, particularly as an entomological constituency frequently expects identification in all stages. The story is easy to decipher if the page has been previously studied, otherwise its translation may be as difficult as that of the Egyptian hieroglyphics. Not infrequently neither the egg, larva, pupa, adult, work or debris is at hand, and the entomologist may be called upon to separate fact from poor or absolutely misleading descriptions. In the latter event, it not infrequently happens that an intimate knowledge of local conditions is of vast service in reaching a satisfactory conclusion.

The work of the economic entomologist only begins with the identification of the insect. This step is simply a means to an end. Now, he is called upon to exercise his proper function as an interpreter and to render an opinion as to the nature of the insect. His prognostication depends upon several factors, the most important of which is a knowledge of the insect and its previous history in the locality under consideration. This is of much service in the case of well known insects but of comparatively little value when an unusual outbreak occurs. Then he must fall back upon his knowledge of the general habits of the group, supplemented in not a few instances by an understanding of the local conditions. Furthermore, he must take into consideration the influence of climate and the likelihood of parasites being abundant enough to check an outbreak in its incipiency. Recommendation naturally follows prognostication and is determined in large measure by the previous findings. It frequently happens that, owing to the nature of the crop infested or the character of the outbreak, direct control measures are impossible. An intimate knowledge of the possibilities may result in a different rotation of crops being advised or modifications in culture. The wisdom of applying direct insecticides, such as the internal poisons or those destroying by contact can be determined only by a variety of conditions. We must take into account the time of year, the condition of the crop, particularly if it be fruit, and the recommendations may not only vary from year to year but be widely diverse in different seasons of the same year.

The Bark Borers are extremely interesting forms and we propose to discuss a number of species very briefly because of the most admirable records they give concerning the identity of the form responsible for the mischief, the time when the injury was inflicted, the sequence of the species working in the bark and a variety of interesting biological data, all of which may be gleaned by a study of their workings.

The small, pale, yellowish, gummy exudations on the limbs of peach trees are very suggestive of the Fruit-tree Bark-beetle (*Eccoptogaster rugulosus*, Ratz.). It is only necessary to make an examination and find the circular exit holes or to disclose the characteristic galleries lying beneath the bark, in order to confirm our suspicions. The early work of this insect is very beautiful, showing the longitudinal gallery made by a single female and the numerous, more slender larval tunnels, the latter increasing in size with their length and ending in a pupal cell. This species is occasionally so abundant in New York State as to literally destroy the inner bark and thickly score the sapwood. This illustration shows such a condition and also represents the work of a wood-pecker. This bird not only removes the outer bark in its search for the grubs and pupæ, but frequently splinters the wood in its eagerness to secure such delicacies. The Hickory Bark-borer (*Scolytus quadrispinosus*, Say) is related to the preceding and has a very similar method of operation. The female enters at one point, continues her gallery with the grain of the wood, depositing eggs on either side. The larval galleries diverge therefrom as in the preceding species. It is comparatively easy to estimate the prolificacy of an individual by counting the larval burrows originating from the tunnel of a female. This species is occasionally very injurious to hickories in New York State. The Red Cedar Bark-beetle (*Phloesinus dentatus*, Say), though rarely abundant enough to cause material injury, is extremely interesting because of the beautiful and very characteristic galleries it makes in its food plant. There is almost invariably a three-lobed chamber at the point of entry, while the long, slender larval tunnels, just grazing the white wood, present a strong contrast to the dark brown bark delimiting their margins. Most interesting of

all, we occasionally find a piece of fossilized wood engraved by one of these borers. We have before us an illustration representing a piece of arbor vitæ from the interglacial beds in the vicinity of Toronto, and the carvings, though faint, tell interesting stories of early life on this continent. The form of these galleries is so characteristic that Dr. Hopkins, our American authority on this group, referred the maker (*Phloesinus squalidens*, Scudd.) to a genus and on account of the restricted food habits of its allies, gave a provisional determination of its food plant. The Ash Bark-beetle (*Hylesinus aculeatus*, Say) presents another type, since the adult galleries diverge from a common point, indicating, as we are told, that two females are probably responsible for their construction. The borings are beautiful in their regularity.

Some of these insects are very injurious to our forest trees, and a study of their habits has therefore a practical, as well as a scientific value. It is interesting to note what can be learned from a large pine tree which has evidently been dead some years. The bark may have largely disappeared, as in the case illustrated, but a close examination of the lower portion of the trunk shows that the sapwood has been badly scored by some borer, and a little familiarity with the habits of these insects would enable us to name the offender. Before attempting this, let us look at the condition of two pines as they were in September. One is apparently in excellent condition while the top of the other has perished. The needles of both, though not shown in the illustration, were decidedly unhealthy and by the following spring the trees were bare and the bark had begun to peel. An examination of the lower portion of the trunk shows a number of pitch tubes, indicating clearly that certain bark beetles had been at work before life was extinct. A pitch tube is nothing more than particles of pitch carried by the insects from their burrows and laid around the mouth of the exit. The insect responsible for this work is known as the coarse writing bark beetle (*Tomicus calligraphus*, Germ.), a species which makes a very characteristic series of galleries and confines its operations almost exclusively to the thicker bark of the lower portion of large trees. Occasionally a dead tree may be found standing and give little external evidence as to the cause of injury. A closer examination may result in finding circular exit holes here and there upon the bark. These invariably mean that insects have been at work beneath. The removal of a large piece of bark may reveal a confused mass of galleries frequently nearly filled by borings and decaying particles of bark. Apparently there is little of significance, but on brushing away the debris, we sometimes find a few galleries preserved by infiltrated pitch, incontrovertible evidence that the pine was attacked while alive. The tree, in making an effort to recuperate from the injury, exudes pitch. This latter infiltrates the walls of the galleries and thus a record of injury may be preserved for years. The bark borer is followed in turn by certain species which live upon the dead inner bark, and in some instances also upon dying wood. One of the most characteristic of these is *Rhagium lineatum*, Oliv., a species which produces, between the bark and the wood, very characteristic pupal cells, the walls of the latter being composed largely of white fibres torn from the sapwood. ***Pytho americanus***, Kirby, is an ally of the same and, like its associate, constructs between the bark and the wood a distinctive pupal cell, the walls of the latter being composed entirely of almost rotten bark borings. The two last named species may also be found in association with Monohammus, the larvæ of which are perhaps better known as sawyers. The exit holes of Monohammus are large, irregular, not sharply defined. The galleries made by the larvæ are easily recognized, since they are broad, irregular, traverse

both bark and wood, occasionally entering the latter to a considerable depth, and are invariably accompanied by coarse, sawdust like borings.

The coarse writing bark beetle mentioned above is usually hardly more than an assistant to the pine bark beetle (*Tomicus pini*, Say). This latter is a smaller form and confines its operations to the thinner bark of the middle of the tree and on the larger branches. Its galleries, like that of its associate working below, are very characteristic and, in some instances, extremely beautiful. Not infrequently this insect breeds in such large numbers that the bark is fairly dotted with its exit holes, while the tissues beneath are riddled by numerous galleries of both adults and larvæ, not to mention the borings of young Monohammus larvæ, frequently found in these situations. Later, Rhagium and Pytho may occur, though as a rule, not so abundantly as under the thicker bark at the base of the tree.

The Balsam Bark-borer (*Tomicus balsameus*, Lec.) is another extremely interesting species. It is occasionally quite injurious to its food plant. The early work begins with an irregular central chamber with two or more transverse adult galleries, the larval burrows being usually with the grain of the wood. This insect breeds throughout the length of the tree and occasionally a group of adults, starting from one central chamber, may entirely girdle a young twig, though this method of work is somewhat exceptional. Three transverse galleries originating from a central chamber is somewhat typical of this insect's work. The plan of operation is frequently obscured in a badly infested tree by interlacing of the galleries and the development of fungus in the decaying tissues. Under these conditions, the only evidence we know of to show that the tree was attacked while alive is the occurrence, in small chambers here and there, of masses of dried balsam. These accumulations usually result from balsam flowing into cavities from injured living tissue.

It will be seen from the preceding that much can be learned from comparatively obscure signs when one understands their significance. The galleries of various bark borers are so characteristic as to permit of the ready identification of most species, and in not a few instances the determination of the plant affected. Furthermore, the condition of the tree at the time of attack can be determined with a considerable degree of confidence and the sequence of the species ascertained. The same is true of insect work in many other groups though it is not always so susceptible of proof. Many times the signs have little or no significance because we fail to comprehend their import.

Records of insect work are sometimes made under other than natural conditions. Certain species invade the house, and, unfortunately, many of us are too familiar with signs of their presence. Occasionally, as in the instance under consideration, the insect is the sufferer. This particular case is of special interest, since it is practically an artificial fossil, a large June beetle (*Lachnosterna*) having been literally crushed into the paper during the process of calendaring. Note the preservation of the antennæ and legs, suggestive of what might be done along this line with other species. Incidentally, we wish to call attention to the melancholy fact that a few individuals, insect as well as human, attain notoriety only when they make an exit from this world in an unusual manner.

Turning now to some forms which are of great interest to residents of cities and villages, allow me to give you a little idea of their importance in an adjacent State. The work of the White Marked Tussock Moth (*Hemerocampa leucostigma*, Sm. & Abb.) is so well known that we unconsciously associate defoliated horsechestnut trees with the presence of this

insect. It has been very destructive in recent years in many cities, and villages of New York, particularly at Buffalo. Furthermore, judging from accounts which have come to our attention, certain Canadian cities have not been altogether free from the ravages of this beautiful caterpillar. The wingless female is probably well known to most who are at all interested in preserving our shade trees, while the characteristic white egg masses need no description at the present time. The control of this insect is easily affected, either by collecting egg masses or thorough spraying with an arsenical poison at the time the young caterpillars begin operations. The selection of one method to the exclusion of the other must be governed largely by local conditions.

The Elm-Leaf Beetle (*Galerucella luteola*, Mull.) is another species which has been very injurious to elms for over a decade in the Hudson valley. It has recently become quite destructive at Ithaca, N.Y., and will presumably inflict considerable injury upon elms in other cities in the western portion of the State. Saratoga Springs and its vicinity seems to be the northernmost limit in New York State where serious injury is likely to occur. It displays a marked preference for the English and Scotch elms and, under certain conditions, may become injurious to the American elm. The larvæ feed exclusively on the lower surface, leaving the tough upper epidermis unbroken. The leaves are skeletonized, only the mid and lateral ribs, supported by a thin, brown membrane, remaining. This habit of the larva makes it imperative to apply the arsenical poison to the under surface of the leaves.

The Snow-white Linden Moth (*Ennomos subsignarius*, Hubn.) attracted a great amount of attention, because the delicate, snow-white moths appeared in myriads about the electric lights of New York City, various other localities in the Hudson valley north to Saratoga and along the Mohawk valley westward to Utica. Reports of similar flights also came from northern New Jersey, from Springfield, Mass., and Ottawa, Canada. This species has not, in recent years at least, attracted notice on account of injuries to shade trees, and even during the past summer there was no marked damage by the caterpillars of this insect to street trees. There were, however, serious outbreaks by this species in both the Adirondacks and the Catskills, the injuries in the latter locality having been preceded by extensive defoliation the preceding year. The light brown, barrel-shaped eggs of this insect are deposited in clusters upon the bark, and a search for them should give some idea as to the probability of the injuries being repeated another season.

The Sugar-Maple Borer (*Plagionotus speciosus*, Say) is rarely seen, though its operations upon sugar maples are very evident in many localities throughout New York State. The initial injury is usually marked by an oblique elevation on the trunk or near the base of the lower branches. This overlies the gallery of the grub and is caused by the abundant formation of new tissues along the line of injury and the consequent pushing up of the old bark. The latter, in case of a bad injury, eventually cracks, exposes the wood, and after a series of years, owing to the deficient circulation, both above and below the oblique part of the wound, the bark dies back till we have a large bare space, usually accompanied by the death of the limbs on that side of the tree. The exposed tissues decay and eventually wind and storm bring about the destruction of magnificent trees. This insect may be regarded as one of the most serious enemies of maples in New York State, though its work is conducted in a very unobtrusive manner.

The Gipsy Moth (*Porthetria dispar*, Linn.) should be mentioned in this connection, though it has not yet been found in New York State. It has

become established in two Massachusetts localities within fifty miles of our line. The control of this insect is of great interest to all States liable to become infested. It would be a rash individual who would dare to say that any locality in the Northeastern United States or in a territory adjacent to the north might not be invaded by this insect within a decade. Defoliated woodlands are characteristic of a bad infestation by this species. The caterpillars not infrequently become so abundant as to form large clusters at the base of trees, sometimes fairly covering the trunks as they range themselves side by side. The caterpillar itself is an inch and a half to two inches long, hairy, dark grayish, with a double row of warts down the middle of the back, the ten anterior blue, the twelve posterior red. The insect is also easily recognized by the heavy bodied, dingy white female lightly and irregularly streaked with black and gray, in connection with the conspicuous yellowish or buff colored, oval egg masses about an inch in diameter and appearing much like a section of a sponge.

The Brown Tail Moth (*Euproctis chrysorrhœa*, Linn.) though a more recent introduction, has become much more widely disseminated than the preceding. It has not yet become established in New York State, though it occurs in Nova Scotia. The winter nests of this species are very familiar, while the snow white, brown-tailed moths and the orange brown caterpillars, with a conspicuous row of white spots on either side and two bright red spots near the posterior extremity, are easily recognized. This insect is not nearly so injurious in Massachusetts as the Gipsy Moth.

The control of these two introduced species is of great importance to all residing in territory likely to become infested, since the more thoroughly the inscet is kept in check, the less chance there is of its becoming established in new territory. Massachusetts authorities are using thoroughly up-to-date power spray apparatus for the application of arsenical poisons to shade and forest treees. Recent improvements have resulted in greatly increasing the capacity of the ordinary spraying outfit by replacing the usual six horse power gasolene engine, weighing some 1,800 pounds, by a ten horse power engine made especially for automobiles and weighing only 400 pounds. Furthermore, a heavier and more powerful pump has been employed, the whole weighing no more than the usual spray outfit. The machinery is mounted upon a stout wagon with a 400 gallon tank, and a heavy inch and a half hose some 400 to 800 feet long, with a smooth quarter-inch nozzle, is employed. A pressure of 200 to 250 pounds is maintained. The hose is handled much as though a fire was in progress. Ten men, at intervals of six or eight feet, carry the end of the hose, the nozzle being in charge of a superior man, with instructions to keep it moving all the time. The pressure is sufficient to throw the insecticide 40 or 50 feet and the resistance of the air breaks it into a fine spray. The foliage is well covered if the nozzle is handled intelligently. This giant outfit is particularly adapted to work in woodlands. It usually requires four horses and is capable of spraying 14 to 16 acres a day, much depending upon conditions. The cost of treatment in this manner is reduced to about $10.20 per acre where the woodland is fairly clear of underbrush. An interesting modification of this apparatus has been employed for spraying strips along the road side, and it could probably be used, under some conditions at least, upon shade trees. It simply consists of a giant extension nozzle mounted on a universal joint so that the tip may be lifted 40 or 50 feet from the ground. This last named apparatus with a favorable wind, can cover a strip 400 feet wide.

The work with parasites of the Gipsy and Brown Tail Moths, conducted by the State of Massachusetts in co-operation with the Federal Gov-

ernment, is most encouraging. The work of 1907 has been considerably extended in providing larger quarters and a more adequate staff. Furthermore, efforts have been made to secure larger sendings from European countries, and a special agent was dispatched to Japan. This latter undertaking has proved most encouraging, in that a large Apanteles and a new egg parasite of the Gipsy Moth have been received from Japan. The Apanteles has been bred through one generation in American caterpillars. The sendings from Japan have, in addition, resulted in the introduction of four species of Tachinidæ which promise to be very efficient parasites of the Brown Tail Moth. Marked improvements have been made in methods of handling and rearing parasites and other natural enemies. This latter justifies the expectation that it would be practical to breed thousands of the more effective species prior to their being liberated under favorable conditions. This work with the parasites may rightly be considered as most important, owing to the fact that the Gipsy Moth is now so widely established as to render any widespread method of control, aside from that with natural enemies, exceedingly costly.

There are several fruit tree insects worthy of mention in this connection, though most of them are so well known that comparatively little that is new can be given. The Codling Moth (*Carpocapsa pomonella*, Linn.) lays heavy tribute upon our fruit growers, causing an annual loss on the apple and pear crop of New York State estimated at $3,000,000. The operations of the Apple Worm are too familiar to require description, and the same is true of the characteristic pupal cells found under the bark. The parent insect is less frequently seen and the transparent, whitish egg, sometimes deposited upon the fruit and frequently upon the leaf, practically escapes observation. Our fruit growers rely almost entirely on thorough spraying with an arsenical poison, making the application when the green sepals are still open. Arsenate of lead, in the experience of one pear grower at least, has proved much more effective than other poisons in controlling this insect upon that fruit.

The Cigar Case-bearer (*Coleophora Fletcherella*, Fern.) has caused much injury to fruit trees in some sections of Western New York. This species appears to be much more destructive in that region than in the Hudson valley. The brown, cigar-like cases are about one-quarter of an inch long and easily recognized by their characteristic form. The young caterpillar, as is well known, eats a little hole into the leaf and then devours the more tender parenchyma lying between the upper and lower epidermis. This habit renders its control somewhat difficult, though an early application of a poison at the time the leaves begin to appear has proved very effective.

The Blister Mite (*Eriophyes pyri*, Nal.) has been unusually destructive in certain orchards in Western New York and its presence has also been noticed in the Hudson valley. The work of this species is quite characteristic though it presents a somewhat superficial resemblance to that of the case bearer mentioned above. The blisters caused by the mite are invariably raised, somewhat thickened, and there is a small, irregular, circular hole near the center of the blister. The venation also disappears in the affected area. These characters serve to separate its work from that of the case bearer mentioned above, while the thickening of the tissues at once differentiates it from fungous attack. Spraying in early spring with either a lime-sulphur wash or a whale oil soap solution has proved effective in controlling this species. The advisability of making such an application must be determined largely by the abundance of the mite.

Several scale insects are more or less common in New York State orchards. An old and common enemy is the Oyster Scale (*Lepidosaphes ulmi*, Linn.), a species which is sometimes quite abundant upon young fruit trees and is especially likely to be numerous on ash. It is easily controlled by thorough applications of either a whale oil soap solution or a kerosene emulsion, the latter part of May or early in June at the time the yellowish young are most abundant. The Scurfy Scale (*Chionaspis furfura*, Fitch) is another old enemy, which in recent years has proved somewhat more destructive than the Oyster Scale mentioned above. It can be controlled in the same way. The San José Scale (*Aspidiotus perniciosus*, Comst.) has become well established in a number of sections in New York State and our more progressive growers are quite confident of their ability to keep the insect in check. Early spring applications of a lime-sulphur wash, or a miscible or so-called "soluble" oil are the two methods most extensively employed. We think it safe to say that by far the most of our fruit growers rely upon some preparation of a lime-sulphur wash and, as a rule, obtain very satisfactory results. The application is generally made in the spring, the more thorough growers making a practice of giving two sprayings, with the wind in opposite directions, whenever possible.

In conclusion, we wish to call attention to one of the most important of economic insects. The welfare of our forests, the preservation of our shade trees and the production of large quantities of farm produce, while valuable and in may ways essential to happiness, is of no avail if life be in danger by reason of neglect of ordinary sanitary precautions. The ubiquitous House-fly, tolerated for ages and assumedly an inevitable nuisance (not to use a stronger word) has come to be regarded as one of our most important economic insects. This change in attitude is due to the recent discovery that, under certain conditions at least, the House-fly may be an important factor in the distribution of typhoid fever and the germs responsible for certain other grave intestinal disorders. It is stated that there are 350,000 cases of typhoid fever annually in the United States, about 35,000 proving fatal. Recent investigations in the City of New York, conducted under the auspices of the Merchants' Association, show a remarkably close parallelism between the abundance of flies and the occurrence of typhoid fever and related infections. It is not necessary at this time to give full details respecting this insect. The House-fly is a child of filth with inherited tastes perverted beyond the possibility of reclamation. Furthermore, its breeding places are comparatively restricted. It is entirely within practicability to reduce its numbers to an almost negligible quantity He who is indifferent to this insect and its possibilities might well dance on the edge of a crumbling cliff overhanging a deep chasm inhabited by one of the most hideous forms of death. This is strong language. The situation justifies it. The suffering of a typhoid patient and the heavy pall of grief falling upon the afflicted family, cannot be adequately depicted by words. The true relation of the House-fly to the welfare of man must be known. This bearer of malignant germs should be excluded from our homes and a campaign begun which should eventually result in the practical eradication of this insect from the haunts of man.

ENTOMOLOGY IN THE GRADUATE SCHOOL OF AGRICULTURE, CORNELL UNIVERSITY, JULY 6-31, 1908.

By Wm. Lochhead, Macdonald College, P.Q.

It was somehow or other unconsciously taken for granted by all students of insect life that Entomology would form one of the parallel.courses offered during the summer session of the Graduate School at Cornell University. To have a School of Agriculture at Cornell without Entomology was hardly possible, even thinkable, for did not four-fifths of all the Experiment Station workers and teachers in Entomology in agricultural colleges receive their inspiration and early training from Professor Comstock and his able staff of co-workers? So it came about naturally that Entomology was placed on the programme of courses, as soon as it was decided that the Graduate School would be held in 1908 at Cornell.

The task of arranging for speakers, topics and dates fell mainly on Prof. Slingerland, who also acted as chairman of each meeting. It was finally decided to have a lecture every morning (except Saturday and Sunday) from 9.30-10.30, and seminars on Tuesday and Thursday afternoons from 3 to 5. By this schedule, the horticulturists at the School were free to attend, and to benefit by the course. This arrangement was welcomed, and many of them attended every lecture.

The first week was assigned to the experts of the Bureau of Entomology at Washington. Dr. Howard gave two lectures on (1) "The Present Condition of Economic Entomology," and (2) "Recent Developments in the Practical Handling of Beneficial Parasitic Insects." Prof. A. L. Quaintance discussed the deciduous fruit investigations of the Bureau of Entomology, and led a large field party in a study of Mr. King's extensive orchards at Trumansburg. Prof. A. H. Hopkins gave one lecture on "The Work of the Bureau of Entomology Against Forest Insects," and conducted a field trip for the study of the common insects infesting trees in the vicinity of Cornell. Prof. F. M. Webster concluded the lectures of the first week by an account of the investigations of insects injurious to grain and forage crops by the Bureau of Entomology.

The second week was assigned to some of the most important Station Entomologists. Prof. P. J. Parrott of the N. Y. Agricultural Experiment Station, Geneva, gave two lectures on methods in planning and conducting co-operative experiments which were very suggestive and helpful. His seminar was devoted to a study of problems which were interesting him at the present time, viz., the pits on apple twigs and branches, made by the tree-cricket; the pits and markings on pear fruit by membracids; the leaf blister-mite in apple orchards; the willow girdler.

Prof. Slingerland described the work of an interesting plum leaf miner (*Nepticula*), and the work of Heterocordalis malinus, a bright red bug which distorts the leaves and fruit of the apple, preferably Greening and Ben Davis varieties.

Mr. Crosby described a new chalcid (*Syntomaspis druparum*) which he found infesting apple seeds.

Prof. E. D. Sanderson, Director of the Vermont Experiment Station, gave two lectures, one on the publications of the State Entomologist, and the other on methods of studying the Codling Moth, and conducted a seminar on the Codling Moth. The work of Prof. Sanderson was highly appreciated by all who took part.

Dr. E. P. Felt, New York State Entomologist at Albany, gave a lecture on the "Work and Systems in the Office of the State Entomologist," giving

particular attention to the methods he adopted in indexing and cataloguing insects, experiments, and correspondence.

The third week was assigned to Dr. Forbes and Dr. Folsom of Illinois. The former in his first lecture discussed the scope of economic entomology, and emphasized the importance of the ecological phase. The Economic Entomologist should study both plant and insect ecology on account of their mutual bearings, and should keep continually before him the humanistic aspect; that is, the value of his results is to be interpreted by their ultimate good to man. Dr. Forbes' second lecture dealt with concrete examples of economic studies, which he himself had made in Illinois, viz., the Northern and the Southern corn-root-worms, the common white grubs, and the aphids of the corn plant. In the period allotted for a seminar, Dr. Forbes described his method of keeping his office records. He keeps (1) an Accession Catalogue, (2) A Species Catalogue, and (3) An Experiment Record. Dr. Folsom gave three most interesting and instructive lectures on the "Insects Injurious to the Clover Plant," and conducted a trip for the study and collection of these insects in the fields. He dealt with the following: *Clover-leaf weevil, Pea aphis, Clover-stem borer, Clover-seed Midge, Clover-seed Chalcid. Clover-seed Caterpillar, Clover-root Borer* and *Clover-hay worm.* A monograph on clover insects will be published soon by Dr. Folsom, who has devoted nearly five years to this subject.

The fourth week was assigned to the Entomological Staff of Cornell University. Prof. Slingerland devoted two lectures to insect photography, to which he has given much attention, so that he is now considered our foremost insect photographer.

Dr. J. G. Needham gave a lecture on "What Shall be Done with the Marshes?" He pointed out that while many marshes should be drained and made valuable as agricultural lands, there are other marshes that should not be drained, as they serve useful purposes, and on account of their location would never be valuable as farm lands. He urged that such areas be made places of beauty and recreation, free from the festive mosquito. Dr. Needham conducted the class to his Marsh Laboratory near Renwick Park and explained the nature of the investigations he was conducting with aquatic forms.

Drs. MacGillivray and Riley gave interesting lectures on the "Methods and Aids in Entomological Instruction." They urged the importance of careful systematic work, not only along the older lines of anatomical and systematic Entomology, but also along the newer lines of morphological and embryological investigations, if many of the problems that are now confronting the economic entomologists are to be solved successfully.

Much credit is due Prof. Slingerland for the excellent course of lectures provided, which every member of the class thoroughly enjoyed.

From the old Cornell students in attendance, the absence of Prof. and Mrs. Comstock—who were taking a well-earned holiday in Egypt and Europe—called forth many expressions of regret, for to most of them the most pleasant memories of their Cornell life are associated with Prof. and Mrs. Comstock in the Entomological Laboratories.

At the close of the proceedings a hearty vote of thanks to Dr. Felt was proposed by Prof. Lochhead, seconded by the Rev. Dr. Fyles, of Quebec, and enthusiastically adopted by the meeting. After a musical selection by the orchestra, the audience joined in singing "God save the King," and the session was brought to a close.

SECOND DAY'S SESSION—FRIDAY, NOVEMBER 6TH, 1908.

The Vice-President, Mr. Tennyson D. Jarvis, took the chair at 9.30 o'clock a.m. in the Biological lecture-room of the Ontario Agricultural College. There was a good attendance throughout the day, composed of students as well as members of the Society. The first order of the day was the reading of the reports of the Council, the Branches of the Society at Montreal by Mr. H. H. Lyman, Quebec by Rev. Dr. Fyles, and Toronto by Mr. J. B. Williams. The reports of the Treasurer, Librarian and Curator were presented by the respective officers, and that of the Delegate to the Royal Society by Mr. Arthur Gibson of Ottawa. This was followed by the election of officers for the ensuing year, 1908-9 (see page 6). Dr. Fletcher was unanimously re-elected President, and Mr. T. D. Jarvis and Dr. E. M. Walker, of Toronto, first and second Vice-President respectively; the latter appointment was made in view of the fear that Dr. Fletcher might be incapacitated from accepting any office. This apprehension proved unhappily to be well-grounded; our reverend and beloved friend died two days later—an account of his life and fatal illness will be found in another part of this report. At a subsequent meeting of the Society held on November the 18th, Mr. Jarvis was elected President and Dr. Walker, Vice-President.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present the report for 1907-8.

The forty-fourth annual meeting of the Society was held at the Ontario Agricultural College, Guelph, on October 31st and November 1st. Many members from a distance, almost all of the local members and a considerable number of interested outsiders, including many of the students of the College, were present.

The first afternoon was devoted to a conference on Fruit-tree Insects. The chief insects discussed were the Fruit-tree Bark Beetle or Shot-hole Borer, which had been doing much damage to Cherry trees in the Niagara district during the season, Codling Worm, Oyster-shell, Terrapin and San José scales, and the Woolly Aphis. This discussion was followed by the "Reports on Insects of the Year" by the directors from their respective divisions of Ontario. In the evening the president, Dr. Fletcher, delivered his inaugural address entitled "The Entomological Outlook." This was followed by a very interesting and instructive illustrated lecture by Mr. A. H. Kirkland of Boston, Mass., on "The Gypsy and Brown-tail Moths in Massachusetts." The morning and evening of the second day were occupied with the reading of reports from the branches and officers of the Society and a series of scientific and practical papers on various subjects. In the evening session Dr. E. M. Walker of Toronto University gave an illustrated lecture on "Collecting and Rearing Dragon Flies at the Georgian Bay Biological Station." All of these papers and addresses have been published in the annual volume.

This volume, the 38th Annual Report to the Legislature of Ontario, was published early in March, and contained 136 pages, and four excellent half-tone plates of Galls from a variety of plants. Besides the papers

already mentioned it included the following articles: "Voices of the Night," by Dr. Fyles; "A Preliminary List of the Scale Insects of Otnario," by Mr. T. D. Jarvis; "The Lime-Sulphur Wash," by Mr. L. Caesar; "An Unusual Outbreak of Halisidota Caterpillars," by Mr. A. Gibson; "Additional Insect Galls of Ontario," by Mr. T. D. Jarvis; "Injurious Insects in Ontario in 1907," by Dr. Bethune; "A Remarkable Outbreak of the Variegated Cutworm," by Dr. Bethune and Mr. L. Caesar; "Two-winged Flies," by Dr. Fyles; "A Report of the Summer Meeting," by the Secretary; and "The Entomological Record," by Dr. Fletcher and Mr. A. Gibson.

"The Canadian Entomologist," the monthly magazine of the Society, has been regularly issued at the beginning of each month. The 39th annual volume was completed in December last and eleven numbers of the 40th volume have already been published.

The volume for 1907 consisted of 423 pages and was illustrated with eleven full-page plates and a number of figures from original drawings. The contributors were 73 in number and included writers in Ontario, Quebec, Manitoba, Alberta, British Columbia, the United States, Cuba, Jamaica, the Hawaiian Islands and England. The articles are for the most part of a scientific character and contain, among much highly valuable matter, descriptions of eleven new genera and 222 new species and varieties of insects belonging to various orders. There is also a series of articles by different authors on subjects included under the title of "Practical and Popular Entomology." The material contained in the volumes of our magazine is so indispensible to specialists in all departments of Entomology that there is a steadily increasing demand for volumes and numbers, and occasionally for complete sets.

The reports from the Branches of the Society at Montreal, Quebec, Toronto and British Columbia are very satisfactory, meetings having been regularly held and many papers read and discussed. The Bulletin published quarterly by the British Columbia Society contains lists of local insects and many notes and observations of a highly interesting character.

From October to the third week in March meetings of the Society have been held every alternate Wednesday evening in the Biological lecture-room of the Ontario Agricultural College at Guelph. The attendance throughout has been satisfactory and a gratifying amount of enthusiasm has been shown by the members throughout the year. The following is a list of the papers read at the meetings: "The Cynipid Galls," by Mr. W. R. Thompson; "The Fight against the Brown-tail Moth in Nova Scotia," by Mr. T. Brady; "Wing Classification of the Heteropterous Land Forms," by Mr. R. C. Treherne; "Parasitism," by Mr. G. M. Frier; "Adaptions of Aquatic Insects," by Mr. L. Caesar; "Fungi that attack Insects," by Mr. J. W. Eastham; "Insects as carriers of Disease," by Mr. T. D. Jarvis; "Reminisscences of Entomologists whom I have known," by Dr. Bethune.

It is with deep regret that the Council records the death in his 67th year of Mr. John A. Balkwill, Director for the London District, and for several years the efficient Treasurer of the Society, which took place at his residence in London on the 10th of October, after a few weeks' illness. While much interested in Entomology, he was particularly devoted to Botany and Horticulture, and was familiar with all the wild plants in the neighborhood of London. He was the first President of the local Horticultural Society and continued to be an active member of its directorate, taking a leading part in its annual floral exhibitions and in the general improvement of the parks, boulevards and gardens of the city. The members of the Council beg

to offer to his widow and family their respectful sympathy in the bereavement that they have sustained.

The Council has also to lament the death of one of the Honorary Members of the Society, Dr. William H. Ashmead, which took place on the 17th of October. For nearly thirty years he was a constant and valued contributor to the pages of the "Canadian Entomologist" and had attained a high reputation among all students of this department of science from the thoroughness of his work. He had devoted himself especially to the study of the Hymenoptera and became the chief authority on the order in North America. His death at the early age of 53 years is a distinct loss to science and leaves a gap that it will not be easy to fill.

Respectfully submitted,

TENNYSON D. JARVIS,
Vice-President.

ANNUAL REPORT OF THE MONTREAL BRANCH.

The 294th regular, and 35th annual meeting of the Montreal Branch was held in the rooms of the Natural History Society, Drummond Street, on Saturday evening, May 16th, 1908.

Members present: Messrs. Geo. A. Moore in the Chair; Henry H. Lyman, E. C. Barwick, G. Chagnon, A. E. Norris, A. F. Winn.

The Secretary read the following report of the Council.

During the season 1907-08 meetings have been held monthly except in July and August, making ten in all, the average attendance being 7½, and two meetings of the Council have been held. The papers read at the meetings were as follows:—

Annual Address of President, Geo. A. Moore.
Hemiptera taken at St. Madeleine, Quebec, May 24, Geo. A. Moore.
Notes on Coleoptera taken at St. Madeleine, G. Chagnon.
An Afternoon at Highgate Springs, Vt., A. F. Winn.
Canadian Cerambycidæ, 1907, G. Chagnon.
Sugaring Record—August, 1907, A. F. Winn.
Hemiperta taken at Lacolle, Quebec, July 19-31, G. A. Moore.
Report on Boston Meeting Ent. Soc. of America, and Work on Browntail and Gypsy Moths, Henry H. Lyman.
A Field of Golden-rod, A. F. Winn.
Notes on collecting Sthenopis thule, E. Denny.
Note on Sphinx Canadensis, E. C. Barwick.
Variations in shade of Samia cecropia, E. Kollmar.
On the Oriental Moth, Henry H. Lyman.
An Account of the Annual Meeting at Guelph, Henry H. Lyman.
Plusia precationis at Petunia blossoms, A. F. Winn.
Further Notes on Hepialus thule, Henry H. Lyman.
Larval habits of Pyrausta theseusalis, walk, G. Chagnon.
An odd Home for a Micro Larva, A. F. Winn.
Another Fortnight at Biddeford, Me., A. F. Winn.
Notes on Hemiptera taken at Biddeford, Me.; Geo. A. Moore.
Collecting and breeding Notes for 1907, Henry H. Lyman.
A few remarks on the Season's Work, E. Denny.

My best Captures for 1907, G. Chagnon.

Notes on the Season 1907, A. F. Winn.

On the attraction of Male Moths to bred females, E. C. Barwick.

Notes on the English Season 1907, L. Gibb.

Habits of Insects as a Factor in Classification, Prof. H. Osborne, (selected) read by Mr. Lyman.

A Trip to Chicago and Decatur, Ill., Henry H. Lyman.

Type and Typical, Henry H. Lyman.

Our Meetings—a Statistical Review, Henry H. Lyman.

Evolution of a Locality Label, A. F. Winn.

North American Species of Monohammus, G. Chagnon.

A little Journey to the Home of Mr. E. P. Van Duzee, G. A. Moore.

Entomological Reminiscences, Henry H. Lyman.

While the average attendance at the meetings is smaller than might be hoped for, it is gratifying to your Council to be able to state, that not only has the work of contributing papers been shared among the members, but also that the total of 34 papers is the largest number for any year in the history of the Branch. During the year we have added four names to our roll, but we have lost from our active list—for the time being—Mr. G. R. Southee, whose business position has necessitated his removal to Calgary, Alta. However, we feel sure he will favor us from time to time with accounts of his work among the butterflies and moths of that vicinity. We had the pleasure of having Mr. C. H. Young of Ottawa at our October meeting.

One field day was held at St. Madeleine, Quebec, on May 24th, but weather conditions were very unfavorable.

The collection of photographs of members has been added to by the presentation of a portrait of the late Mr. Robert Jack.

In the library have been placed copies of the current numbers of the Canadian Entomologist, the annual report of the Parent Society for 1907, report of the South London Entomological Society, 1907, Dr. Fletcher's "Weed book," the N. Y. State Entomological publication and the Plates of Wright's Butterflies of the west coast.

The Curator's duties have not been made arduous by the addition of any new specimens, but the collection is in good condition, and any duplicates the members can spare will be very acceptable. The Treasurer presented a statement showing a balance on hand of $65.35.

The following officers were elected: President, Geo. A. Moore; Vice-President, Henry H. Lyman; Secretary-Treasurer, A. F. Winn; Curator and Librarian, L. Gibb; Council, E. C. Barwick, G. Chagnon and E. Kollmar.

ALBERT F. WINN, *Secretary-Treasurer.*

REPORT OF THE QUEBEC BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The season of 1908 has been a very remarkable one. We have had a long continuance of fine weather and a great lack of rain. The long drought dried the leaves on the trees and they began to fall before the frosts came.

There have been destructive forest fires all around us, and the air has been full of smoke—at times so dense as seriously to impede navigation.

In consequence, there have been but few insects on the wing, but Mrs. Turner took a lovely specimen of *Hyphoraia parthenos*, Harris, at her summer residence on the Island of Orleans. Mr. Boulton captured several interesting specimens on the same island, amongst them one of *Phycanassa viator*, Edw. This insect is rare in our locality.

We are greatly indebted to Miss Freeman for several valuable donations for our cabinet, of choice specimens from the South and West of America.

We have heard with deep concern of the serious illness of J. H. Simmons, Esq., a member of our council. Many earnest prayers are offered on his behalf.

The Rev. Dr. Fyles has retired from the position of chaplain at Quebec for the S.P.C.K., and intends to move from this neighbourhood shortly. He has therefore felt called upon to present his resignation of the office of president of the Branch. He has done so with regret. The loss of his valuable services will be greatly felt by the members of the Branch whose best wishes accompany him to his new home.

(Signed) R. A. M. Boulton,
President.

Crawford Lindsay,
Sec.-Treasurer.

Report of Council.

The Branch now numbers 29 members.

The secretary-treasurer's report will be submitted to you.

During the year papers were read on the following subjects:—

By the President, Rev. Dr. Fyles: "Two-winged Flies," "Variations in Insects," "Southern Hawk Moths," "Form and habits of the mole cricket."

By Mr. R. A. M. Boulton: "Moths collected by the electric light at Montmorenci Falls," "Buterflies of the New Forest, England."

The thanks of the Branch are due to the authorities of Morrin College for allowing the members the use of their rooms.

(Signed) Crawford Lindsay,
Sec.-Treasurer.

At the annual meeting held on the 24th October, 1908, the officers for the coming year were elected as follows:—

Honorary President: Hon. R. Turner, M.L.C.

President: Mr. R. A. M. Boulton.

Vice-President: Mrs. R. Turner.

Secretary-Treasurer: Lt.-Col. Crawford Lindsay.

Council: J. H. Simmons, Esq., James Geggie, Esq., Miss Bickell, Miss Freeman, Miss Hedge.

(Signed) Crawford Lindsay,
Sec.-Treasurer.

REPORT OF THE TORONTO BRANCH OF THE ENTOMOLOGICAL SOCIETY FOR 1907-8.

The twelfth annual meeting of the Society was held on Tuesday, May 26, 1908, in the Provincial Museum, St. James' Square.

The President, Dr. Brodie was in the chair, and the following members were present:—Mr. Coleman, Mr. Webb, Mr. Williams, Mr. Woods, Miss Blackmore, Dr. Abbott.

The following officers were elected for 1908-9:—

President: Dr. Brodie.

Vice-President: Dr. Walker.

Secretary-Treasurer: Mr. Laing.

Librarian: Mr. Williams.

Curator: Mr. Laing.

Council: Mr. Woods, Mr. Webb, Mr. Ivey, Dr. Abbott.

During the past year 12 meetings were held with an average attendance of 8. The Society also spent a day at Niagara Glen which was both profitable and enjoyable.

The membership of the Society has increased to 30. As a number were comparatively young in the study of Entomology, an effort was made during the past winter to study the orders systematically. A committee for identification was also formed so that members might have some assistance in identifying their specimens. The study of Botany, in so far as it relates to the life history of insects, has also been introduced.

The work of making as complete a record as possible of the fauna and flora of Niagara Glen has also been proceeded with and reports from several members have been made.

The subject of Insect Mimicry has received much attention, and discussion, as the list of papers appended will show.

The treasurer's report shows the finances to be in a satisfactory condition with a balance in hand of $4.51.

List of Papers Read.

Characteristics of the Order Orthoptera—Dr. Walker.
Defence of Theory of Mimicry—Dr. Walker.
Insect Mimicry and Evolution—Dr. Brodie.
The Order Lepidoptera—Mr. Williams.
Arrangement of Insects according to habit—Dr. Brodie.
Interior of Africa—Mr. Thurston.
Galls—Mr. Cosens.
Relation of Plants to Insects—Mr. Ivey.
Aquatic Hemiptera—Dr. Walker.

Respectfully submitted,

E. Blackmore,
Sec.-Treasurer.

FINANCIAL STATEMENT.

Of the Entomological Society of Ontario made to the Department of Agriculture for the Province of Ontario for the year ending August 31st, 1908.

Receipts.

Cash on hand from previous year as per last report	$640 73
Members' fees and subscriptions to "The Entomologist"	402 31
Sales of cork, pins, etc.	68 49
Sales of back numbers of "Entomologist"	121 70
Advertisements in "The Entomologist"	52 75
Government grant	1,000 00
Interest on bank deposits	11 28
Printing—Sale of extra pages, cuts, etc.	32 20
Expenses—Return of postage by Government, etc.	10 41
Total	$2,339 87

Expenditures.

Supplies of pins, cork, etc.	$51 67
Back volumes	2 00
Fees remitted	5 11
Printing	869 02
Expenses—Postage, express, etc.	47 42
Annual meeting	109 31
Library	11 31
Annual report	114 29
Salaries	300 00
Honorarium—Dr. Bethune for services in moving headquarters	50 00
Total	$1,560 13
Balance on hand August 31st, 1908	$779 74

Examined and found correct this 5th day of November, 1908.

J. W. Eastham, }
J. W. Crow, } Auditors.

STATEMENT OF ASSETS AND LIABILITIES.

Assets.

Cash in bank	$779 74
Books and magazines in library	2,500 00
Museum	1,600 00
Wood cuts, plates, electros, etc.	700 00
Office furniture	75 00
Back numbers of the Canadian Entomologist and annual reports	850 00
Microscopes	225 00
	$6,729 74

Liabilities.

Nil.

S. B. McCready,
Treasurer.

CURATOR'S REPORT.

During the past year, as in previous years, the curator's work has been chiefly the general care and supervision of the Society's collections and the recording and placing of new specimens received from members of the Society. Last year lists of the species especially desired for the Society's collections were prepared and sent out to some of the members. These lists were long and contained many common species and gave the idea to some of the members who received them that the Society's collections were far from being representative of the fauna of Canada. This, however, is not the case as nearly all the common species appearing in the lists are in the Society's collections but many of them lack date and locality labels, and some of them are old and imperfect specimens. Thus they were included in the lists in the hope that in time all the common species might be represented in the Society's cabinets by perfect specimens bearing date and locality labels.

Since the last report the following contributions have been received and our sincerest thanks are due to the generous contributors for the same: 6 specimens of Coleoptera, by A. Gibson, Ottawa; 2 specimens of Lepidoptera, by James Fletcher, Ottawa; over 200 specimens of Lepidoptera, by Mr. F. H. Wolley Dod, of Millarville, Alberta; 50 specimens of Lepidoptera, by Mr. Charles R. Ely, of Washington, D.C.; 87 specimens of Cuban Lepidoptera, by Mr. Charles T. Ramsden, Guantanamo, Cuba.

In conclusion, the curator begs to remind the members of the Society that specimens, especially of rare and new species, are always most acceptable, and help to make the Society's collections more representative and of more value to every member of the Society.

Respectfully submitted,

J. E. Howitt,
Curator.

REPORT OF THE LIBRARIAN.

During the year ending August 31st, 1908, forty-nine bound volumes have been added to the Library, making the total number on the register 1,971; also a very large number of periodicals, pamphlets and bulletins, many of which will be bound during the next few months. Among the new books may be mentioned the English reprint by Mr. P. Wytsman, of Brussels, of Hubner's Sammlung Exotischer Schmetterlinge (*Lepidoptera Exotica*), edited by Mr. W. F. Kirby, of the British Museum; this work, which has been issued in parts during the last fourteen years and is now completed, forms three large quarto volumes and contains 491 hand-coloured plates of Lepidoptera, carefully copied from the originals, together with notes by the Editor on all the species depicted. The Farm Weeds of Canada, by Dr. Fletcher, with coloured illustrations of a large number of species, is another noteworthy addition to the useful books in the library. Thirty-eight volumes have been taken out by members during the year, but this does not at all indicate the use that has been made of our books as they are being consulted almost daily by students and members of the Society.

Respectfully submitted,

Charles J. S. Bethune, *Librarian.*

REPORT TO THE ROYAL SOCIETY OF CANADA.

By Arthur Gibson, Ottawa.

As delegate from the Entomological Society of Ontario, I have the honour of presenting the following report of the work of the Society during the past year.

The annual meeting of the Society was held on October 31st and November 1st last, at the Ontario Agricultural College, Guelph, the headquarters of the Society. This meeting was a most successful one and a large number of prominent entomologists and others were in attendance during the two days' session. A feature of the annual meeting of this Society is the reception and discussion of the reports of the directors of the six Districts in Ontario into which the economic work of the society is divided. In these reports mention is made of the insects which have been particularly destructive during the season. The annual report of the Society appeared in March last and in this an account of the proceedings of the above meeting are given, as well as most of the papers which were presented at the sessions. Among these latter the following may be mentioned:

"The Entomological Outlook" (Presidential Address). By Dr. J. Fletcher.

"The Gypsy and Brown-tail Moths in Massachusetts." By Mr. A. H. Kirkland.

"Voices of the Night." By Rev. Thos. Fyles.

"Collecting and Rearing Dragon-flies at the Georgian Bay Biological Station." By Dr. E. M. Walker.

"A Preliminary List of the Scale Insects of Ontario." By Mr. T. D. Jarvis.

"The Lime-Sulphur Wash." By Mr. L. Caesar.

"An Unusual Outbreak of Halisidota Caterpillars." By Mr. Arthur Gibson.

"Additional Insect Galls of Ontario." By Mr. T. D. Jarvis.

"Injurious Insects in Ontario in 1907." By Rev. Prof. Bethune.

"Entomological Record, 1907." By Dr. James Fletcher and Mr. Arthur Gibson.

During the year the Society also held a summer meeting at the Ontario Agricultural College, on July 4 and 5, when interesting papers were presented by Mr. H. H. Lyman on "Thecla calanus and edwardsii"; Mr. C. W. Nash on "Balance in Nature"; Dr. Henry Skinner on "Insects as Carriers of Diseases"; Dr. J. Fletcher on "Nature Study as a Means of Education"; Dr. W. Brodie on "The Life-history of a Colony of the Tent Caterpillar," and Mr. C. W. Nash on "Instinct *vs.* Education." An excursion was also held to Puslinch Lake, about nine miles from the college, many specimens of interest being collected.

The Branches of the Society at Quebec, Montreal, Toronto, Guelph and Vancouver, have all been actively at work during 1907, and much useful work in entomology is being thus encouraged at all of these centres. Regular meetings during the winter have been held by all of these Branches of the Society and many interesting papers have been presented and discussed.

During the year 22 bound volumes have been added to the Society's library at Guelph, besides a large number of periodicals, bulletins and pamphlets. Many of these latter are being bound up into permanent volumes.

This library which is one of the most complete entomological libraries in America is continually being used by members of the Society and by students specializing in entomology at the Ontario Agricultural College.

The collections of insects belonging to the Society have been materially added to during the year and considerable work has been done in going through the cabinets and rearranging the specimens.

The Canadian Entomologist, which is published by the Society, is now in its 40th volume. Volume XXXIX, which ended with the December, 1907, number comprised 423 pages, with 11 full page plates and 23 figures in the text. No less than 73 different entomologists contributed to the volume, and 11 new genera, 216 new species and 5 new varieties are described.

These papers are of a high character and in a report like this it is impossible to mention very many of them. Some of the more important, however, are. "New Micro-lepidoptera," by Mr. W. D. Kearfott; "New species of North American Lepidoptera," by Dr. W. Barnes; "Notes on Chalcolepidius and the Zopherini," by Major Thos. L. Casey; "On the Classification of the Mosquitoes," by Dr. Harrison G. Dyar and Mr. Frederick Knab; "A New Somatochlora, with a Note on the Species known from Ontario," by Dr. E. M. Walker; "Habits of some Manitoba 'Tiger Beetles' (*Cicindela*)," by Mr. Norman Criddle; "Studies in the Genus Incisalia," by Mr. John H. Cook; "The Eupitheciae of Eastern North America," by Rev. G. W. Taylor; "List of Hemiptera taken at Como, Quebec," by Mr. G. A. Moore; "The Classification of the Culicidae," by Miss Evelyn Groesbeeck Mitchell; "The Stridulation of the Snowy Tree-cricket (*Œcanthus niveus*)," by Mr. A. Franklin Shull; "New Coleoptera from the Southwest," by Mr. H. C. Fall; Tenthredinidae of Colorado," by Mr. Geo. P. Weldon; "New Tropical American Hesperidae," by Mr. Geo. A. Ehrmann; "Perlidæ from British Columbia and Alberta," by Mr. Nathan Banks; "*Diplonychus*, Laporte (—*Hydrocyrius*, Spinola), and its Relation to the other Belostomatid Genera," by Mr. J. R. de la Torre Bueno; "New species of Colorado Aphididæ, with Notes upon their life-habits," by Prof. C. P. Gillette: "Further Notes on the Occurrence of Hepialus thule, Strecker, at Montreal," by Mr. H. H. Lyman.

Besides the above technical papers, the following appeared under the heading "Practical and Popular Entomology":

"How Insects are Distributed." By Mr. L. Caesar.

"A Homemade and Effective Insect Trap." By Mr. John D. Evans.

"The Scolytidae or Engraver-Beetles." By Mr. J. W. Swaine.

"The Walking-Stick Insect" (*Diapheromera femorata*). By Mr. J. B. Williams.

"Fumigation with Hydrocyanic Acid Gas for Beginners." By Prof. Glenn W. Herrick.

The Society now has 185 Canadian members. The Canadian Entomologist is sent out to 486 subscribers each month as it is issued. Besides the subscribers there are on the Exchange List, the names of 112 Societies, etc., which receive the Canadian Entomologist regularly.

THE ECONOMIC IMPORTANCE AND FOOD HABITS OF AMERICAN GALL MIDGES.

By E. P. Felt, Albany, N.Y.

The extensive and frequently severe depredations of the Hessian-fly, *Mayetiola destructor*, Say, are too well known to require extended notice in this connection, and the same is also true, though perhaps in a more limited sense, of the Wheat Midge, *Cecidomyia tritici*, Kirby. The genus Contarinia appears to be a very important one to the economic entomologist. It contains the somewhat well known Pear Midge, *Contarinia pyrivora*, Riley, a species which has been responsible in recent years for the destruction of considerable fruit in Connecticut, New York, New Jersey and presumably in adjacent states. A more recently discovered species is known as the Violet Midge, *Contarinia violicola*, Coq., a form which has proved a serious enemy of the extensive violet growing industry located in and about Rhinebeck, N.Y., and one that bids fair to cause more injury in the future unless growers are very careful to avoid conditions favorable for its multiplication. The Sorghum Midge, *Contarinia sorghicola*, Coq., another recent discovery, breeds in sorghum seed and, in recent records, has been credited with causing the common failure of this plant to produce a full crop of seed. A still later note states that this insect destroys all sorghum seed in Texas south of a certain line. The Cotton Midge, *Contarinia gossypii*, Felt, is a species of some economic importance, since it has been reported as injurious to cotton in the British West Indies. Still another form, *Contarinia negundifolia*, Felt, was reared from the leaves of a box elder and is possibly identical with the *Cecidomyia negundinis*, Gill., a species which has been recorded as decidedly injurious to its host plant on the college campus at Ames, Iowa.

There have been several other injuries by Cecidomyiidæ brought to notice recently. One of these is the extensive destruction of linden buds by a form which we have been unable to rear as yet. This insect was so abundant at Rhinecliff, N.Y., as to destroy from 50 to 75 per cent. of the buds on large trees, causing the death of numerous twigs and of a few large branches. Similar injury to young Catalpa trees has recently been recorded by Prof. Gossard and is probably due to the work of *Cecidomyia catalpæ*, Comst. Several years ago a small proportion of the grape blossoms in the Chautauqua grape belt were found infested by Cecidomyiid larvæ. This last season the insect, *Cecidomyia Johnsoni*, Sling., was so abundant in an acre of Moore's early grapes near Fredonia, as to destroy from 60 to 75 per cent. of the crop. Observations have shown this pest to be generally distributed throughout the grape belt, and it is very probable that some other mysterious failures of the crop were due to the work of this insect. A number of species are known to live in the buds of plants, and it is presumable that other bud-inhabiting forms, aside from those mentioned above, have caused or are able to cause serious losses. It is certain that members of the Cecidomyiidæ are capable of inflicting grave injury, and no scientist can state that any one species might not become destructive in the near future. More knowledge respecting this group is necessary before its economic status can be accurately fixed.

It is gratifying to state that some species of Cecidomyiidæ at least, are distinctly beneficial. The members of the genus *Aphidoletes*, Kieff., live at the expense of aphids, and are therefore beneficial. One species, *A.*

meridionalis, Felt, was reared a number of years ago from *Siphonophora liriodendri*. *Aphidoletes cucumeris*, Lintn., undoubtedly preys upon the melon louse, *Aphis gossypii*, Glov., though when it was described by the late Dr. Lintner as a *Diplosis*, it was supposed to be responsible for a bud gall. Another species of *Aphidoletes*, bred from the melon aphis and probably *A. marina*, Felt, was recently received from Prof. C. P. Gillette of Colorado, accompanied by the statement that it was particularly destructive to plant lice in the Insectary and was not uncommon out of doors, attacking different species of plant lice. The genus *Mycodiplosis*, Rubs., is zoophagous and it is gratifying to note that *M. acarivora*, Felt, preys upon the red spider infesting the Citrus trees of California.

The above is sufficient to show that the food habits of this group are of interest to the economic entomologist. We now propose to gvie some brief notes respecting the habits of various members of this family. The Campylomyzariæ include a considerable number of forms most frequently found in forests or in association with decaying vegetable matter. The very characteristic genus *Joanissia*, Kieff., presumably breeds in decaying vegetable matter, since Kieffer records rearing several species from decaying wood, tufts of moss and mold covering a fungus. Members of the genus *Campylomyza*, Meig., are rather common in woodlands. One species, *C. lignivora*, Felt, was reared in considerable numbers from the fungous affected heart wood of pine. The long, yellowish larvæ evidently eroded the tissues to a considerable extent, as the cavities inhabited by them were more or less filled with extremely fine wood flour. *C. pinicorticis*, Felt, was bred from galleries of a *Scolytid* in pine. *Campylomyza coprophila*, Felt, was obtained from manure, while *C. dilatata*, Felt, was reared from a vial containing elm seeds and debris. One species, *Campylomyza pomifloræ*, Felt, occurs commonly in early spring about blossoms of cherry and shadbush. The peculiar *Miastor americana*, Felt, was taken on either beech or chestnut leaves. Several species of *Brachyneura*, Rond., have been reared, *B. eupatorii*, Felt, being obtained presumably from an oval swelling on the stem of thoroughwort *Eupatorium perfoliatum*, and another, *B. vitis*, Felt, was reared from a jar containing the familiar *Lasioptera vitis*, O. S., gall on grape.

The Lasiopterariæ is a very characteristic group, the members of which appear to invariably undergo their final transformations within the tissues of the host plant. The peculiar *Clinorhyncha* seems to be restricted to the blossoms of certain compositæ, since *C. millefolii*, Wachtl., occurs in apparently normal florets of Yarrow, *Achillea millefolium*, while *C. eupatori-floræ*, Felt, may be obtained from similar flowers of thoroughwort *Eupatorium perfoliatum*. *Baldratia*, Kieff., is another exceedingly interesting genus, since most of its species breed in the peculiar, apparently fungous affected blister galls so common on aster and solidago. The sixteen species reared are divided about equally between species of aster and solidago. A few forms have been obtained from comparatively normal leaf tissues, and one interesting species bred from small, oval galls on aster leaves recognized simply by a slight elevation on the under surface. Members of the genus *Lasioptera* and *Neolasioptera* occur almost exclusively in stem galls on herbaceous plants and in subcortical galls on woody plants. The irregular eccentric stem gall of *Lasioptera tumifica*, Beutm., on solidago is an excellent type of one form of gall, while the irregular subcortical gall on Cornus, made by *Neolasioptera cornicola*, Beutm., illustrates the other. The species of both genera winter, so far as known, within the gall, those

inhabiting herbaceous plants usually appearing in rather early spring, while certain of the forms occurring in woody tissues do not emerge till June.

Representatives of the genus *Dasyneura* exhibit a marked preference for leaf folds, leaf buds or loose leaf bud galls. *Dasyneura anemone*, Felt, occurs in a loose apical bud of *Anemone canadensis*, while *D. clematidis*, Felt, inhabits an oval stem gall. The genus *Rhabdophaga*, as we understand it, exhibits a marked partiality for the willow, breeding for the most part in bud galls or woody tissues. Some eighteen species are known to inhabit this plant.

The Oligotrophiariæ is best represented by the genus *Rhopalomyia*, which latter displays a very marked preference for solidago, fifteen species occurring on this plant and subsisting at the expense of the flowers, the leaves, the stems, or even on portions of the underground root stocks. The species are easily reared and, so far as we have been able to determine, each is responsible for a peculiar type of gall. Six species of *Mayetiola* have been reared from willow, *M. walshii*, Felt, producing an apical rosette gall, *M. rigidæ*, O. S., forming a characteristic apical beak gall, while the other species occur in woody tissues.

The Asphondyliariæ is a very well marked group exhibiting considerable similarity in habit. The typical genus *Asphondylia* may well be represented by the common *A. monacha*, O. S., a species which breeds in both solidago and aster. It has been reared from apparently unaffected blossoms of plants belonging to both genera. It occurs in small rosette galls on the narrow-leaved solidago, *Euthamia lanceolata*, and has been reared from what we have designated as the adherent leaf gall on *Solidago canadensis* and *S. serotina*. This latter gall is simply an oval cell formed by two leaves adhering at the margin of the cavity. Most of the species of *Asphondylia* occur in bud galls, and it is probable that some forms are injurious. The allied *Schizomyia* likewise breeds in bud galls or may be responsible for modifications of the same such as the hard, nut-like, polythalamous gall of *Schizomyia pomum*, Walsh, much better known as *Cecidomyia vitis-pomum*. A large, oval or fusiform petiole or tendril gall is made by *S. petiolicola*, Felt. The genus *Cincticornia* is also included in this group and breeds, so far as known, in leaf galls. *Cincticornia caryæ*, Felt, was reared from a conical leaf gall on hickory, while *C. pilulæ*, Walsh, better known under the name of *Cecidomyia*, inhabits the common reddish, ovate hard leaf gall on oak.

The Diplosariæ includes a large number of forms most easily recognized by the two swellings on each antennal segment in the male. Practically nothing is known concerning the life history of the larger, heavier forms of *Hormomyia*, though some of the smaller, lighter forms have been reared, such as *H. caryæ*, O. S., and *H. holotricha*, O. S., both better known under the name of *Cecidomyia*. *H. cratægifolia*, Felt, has been reared from a cockscomb gall on Cratægus leaves. *Cecidomyia resinicola*, O. S., is interesting because the larvæ occur in pitch masses. Many species belonging to this group may be bred from buds or leaves and a few, as mentioned in the preceding economic discussion, from seeds. We have reared a number of species of *Mycodiplosis* and particularly of *Lestodiplosis* from various leaf galls. The habits of these species are not sufficiently well known so that we feel certain that in every instance we have secured the form responsible for the deformity. There is still need of much life history work in this group before certain puzzles as to relationships and food habits can be satisfactorily solved.

Comparatively little is known concerning the food habits of our Epidosariæ. *Asynapta saliciperda*, Felt, has been reared from old, dried *Rhabdophaga batatas*, Walsh, galls, while *Winnertzia pinicorticis*, Felt, was bred from under the bark of *Pinus inops*. This group presents great structural variations and it is to be expected that further investigations will disclose considerable variation in habits.

The Cecidomyiidæ show some exceedingly interesting preferences in the selection of food plants. For example, 39 species have been reared from solidago, 15 of these belonging to the genus *Rhopalomyia;* 28 species have been bred from Salix, 16 from aster and 10 from grape. *Lasioptera* exhibits a marked partiality for aster and solidago. The latter is also a prime favorite with *Rhopalomyia*. The genus *Rhabdophaga* occurs mostly in *Salix* and a number of species of *Mayetiola* also live upon this plant. The species of *Asphondylia*, probably because of their inhabiting buds, do not display a marked preference for any food plant. The Asphondylid genus *Cincticornia* is found largely in leaf galls on Quercus, while the smaller forms of Hormomyia are equally partial to various hickory leaf galls. The statistics just given are based upon rearings of over 300 species. The data presented can not be regarded as conclusive because most of the rearings have naturally been made from plants most easily secured or from which insects were most readily bred. Some idea of the extent and complexity of this work may be gained when it is remembered that we now know some 700 North American species, representing about 50 genera.

After some remarks upon the paper by the Chairman, a discussion arose respecting the nomenclature of galls and the insects that produce them, which was participated in by Messrs. Jarvis and Nash and Drs. Felt and Bethune. The conclusion arrived at was that names employed to designate botanical structure alone should not necessarily be attached to zoological species, that is to say that a name given to a gall with a description of the gall only and perhaps also of the larva found in it should not hold in entomology; that the only specific names to be recognized should be based upon the description of the adult perfect insect. Otherwise it was felt that great confusion must sooner or later arise.

Mr. W. R. Thompson, of the Ontario Agricultural College, Guelph, gave an interesting account of the work now being carried on in Massachusetts for the rearing of native and imported parasites of the Gypsy and Brown-tail Moths. He was engaged during the summer months as an assistant to Mr. C. H. T. Townsend, who is in charge of the parasitic work, especially as regards the Dipterous family Tachinidæ. Mr. Thompson described fully and clearly the various operations carried on in connection with the importation of nests of Brown-tail Moth caterpillars, predaceous beetles, etc.; and the methods employed in rearing the larvæ and obtaining the parasites on their emergence from the host caterpillars. He also explained some of the apparatus used by means of drawings on the blackboard. His narration was listened to with much attention and gave those present an excellent idea of this notable experiment in economic Entomology. As Dr. Howard, who is in charge of the whole work, sent a paper on this subject, which was read at the evening session, Mr. Thompson preferred that his descriptions should not be published.

OBSERVATIONS ON THE SORGHUM MIDGE.

By R. C. Treherne, Ontario Agricultural College, Guelph.

Before commencing the discussion of my subject, I should like it understood at the outset that the observations recorded have not yet been confirmed by repetition, and, no doubt, therefore, some of them may not be entirely correct. The first study of the life-history of any insect is apt to be wrong in many respects, as we find, for instance, was the case with the first published statements made at the beginning of the Mexican Cotton-boll Weevil investigations, I purpose, therefore, to give a mere outline of such observations on the life-history, distribution and habits of the Sorghum Midge as came under my notice during this summer of 1908, and crave indulgence for the apparently inconclusive form of some of my records. Again I ask you to bear in mind that the work was undertaken by a student, the result of whose work still awaits proof.

Sorghum is grown in Louisiana in comparatively small areas, nearly every plantation, however, possessing a patch which rarely exceeds half an acre in size. General, therefore, as the growing of this crop would seem to be, it has for a considerable time been regarded as one which did not mature its seed. Investigations into the cause of this non-maturity did not greatly exercise the minds of the planters for the reason that the crop was not grown for its seed production, but was grown rather for green feed and for the manufacture of molasses. General theories were advanced as to the cause of this non-fruitage, but the attacks of the Sorghum Midge on the ovaries of the sorghum plant now seem to be the most potent and the main cause as yet determined. Yet it would be incorrect to say that the failure of sorghum to mature its seed in Louisiana was entirely due to the work of this midge, for the reason that the Sugar-cane Borer, *Diatræa saccharalis*, F., the moth *Nigretia sorghiella*, Riley, the Sorghum Smuts, the English Sparrows and I have no doubt yet other destructive agencies, are all means which help to prevent the sorghum crop from maturing its seed in the South.

So far as we know, this insect was first mentioned and described by Professor D. W. Coquillet in Bulletin 18, N. S. Bureau of Entomology, on "A Cecidomyiid Injurious to the Seeds of Sorghum." His description was taken from some specimens sent from Alabama in 1895. The midge seems not to have attracted further attention until 1907, when Mr. C. R. Ball, of the U. S. Department of Agriculture made a number of observations on its destructiveness in Louisiana. During this summer of 1908, systematic investigations on the life-history and habits of this midge, were begun, with the result that Professor F. M. Webster, who has the matter in hand, possesses considerable data to verify and to resume work on, if so desired, at an early date next year.

With the adult flies of this species, the two sexes are of practically the same dimensions, the females, however, on a superficial examination, appearing, on account of their length of ovipositor and somewhat plump abdomens, to be the larger. The abdomens of both sexes are brick red in general color, while their heads and thoraxes present black indications. The antennæ of the males are considerably longer than those of the females and it is by this characteristic that the two sexes are most easily recognized. The females are somewhat more sluggish in their movements than the males. The males, on the other hand, are the more active and are usually seen on

the wing hovering around the heads of sorghum in the early morning, evidently awaiting the emergence of the females. The total length of the life of the female is about 32 hours, that is to say, when facilities for the deposition of her eggs are given her soon after emergence. The males live about half as long as the females. No attempts to breed this fly to maturity under artificial conditions were successful.

The egg is elongate in form and cylindrical, tapering towards the end and is about .28 mm long and about .09 mm broad and resembles very nearly the eggs of closely related species. It is laid by the female fly between the glumes of the sorghum spikelet and on or very near the ovary of the plant so that when the young larva develops it may find abundance of food ready at hand without material need of any search. The injury to the ovary of the plant is caused, evidently, by absorption of the juices of the ovary by the larva which appears to carry out the extraction throughout the entire length of its body. The larva when full grown is brick red in general color and the developing pupa possesses the same characteristic shade. When the period for transition from pupa to adult approaches, the pupa works its way upwards and the emergence occurs at the apex of the glumes. After emergence takes place, several seconds are allowed for wing development.

I think I may mention here that there is, at present, in Louisiana an extremely interesting but obnoxious little ant, *Iridomyrmex humilis*, Mahr. This ant is over-running the southern portion of the State and is having considerable attention given to it by reason of its relationship to the agricultural interests of the State. In the sorghum patch in which the experiments with the sorghum midge were carried on this summer, this particular ant abounded. The ants were continually running about the leaves, stems and heads of the sorghum plants attracted evidently by the sweet sap of the plant and the excretions of the aphid which fed upon it. As the adult fly is about to emerge from the pupa, the glumes of the plant are necessarily forced slightly open and the ant, which is omnivorous, is thus allowed to gain access to the helpless pupa. I actually observed an instance where an ant bit off the terminal apex of the glumes and extracted the pupa. Other instances were observed in which the ant was unable to make its way to the enclosed pupa, probably, I suppose, on account of the glumes not being sufficiently open and hence not allowing of a good hold. I have no doubt that in a field in which this ant abounds, the death of many flies may be accounted for.

The total life-history of this species, according to Mr. C. R. Ball, varies from 14 to 20 days. This summer it was estimated that it ran perhaps somewhat longer, between 19 to 25 days. However, this is one of the points that still awaits proof. The entire life-history takes place within the sorghum flower, the egg being deposited there and the adult fly emerging from it when the required developmental period is accomplished. The general habits of this midge, therefore, can be seen to coincide very closely with the habits of already studied and familiar species of the same genus and closely related genera.

In Louisiana this midge is heavily parasitised by *Aprostocetus diplosidus*, Crawford. This parasite is accompanied by a species of Tetrastichus which Professor F. M. Webster considers as probably a secondary parasite.

In reference to the distribution of the midge, I may say that it is more generally to be found over the South than it was first thought. Early in the summer it was known to exist in comparatively few States, but it now appears that it has actually been found in Texas, Louisiana, Alabama, Arkansas, Missouri and South Carolina. For the reason that this midge

has not yet attracted the attention of the Experiment Stations, it is altogether probable that it is of more general distribution than these statements show. Its destructiveness, too, is of a varied description. In the alluvial lands of Louisiana, for instance, the main part of the crop is completely spoilt, while in the hill lands of the State, the crop is not so affected and again in Arkansas and Missouri the attacks of the midge are so inconsiderable that its presence would not be suspected.

I will close these remarks by asking an apology for placing before you records of an insect which is probably of only semitropical distribution, but I thought that, as its method of attack closely resembles the attack of nearly related species in the North and as these are practically some of the first remarks on this particular species, this paper might be of interest.

Mr. Treherne then exhibited a Cotton Plant which was grown in the College greenhouse and pointed out the various stages of growth—the bud, the square, the flower and the boll. The only time during the growth of the plant that poison can be satisfactorily applied against the plant's chief enemy, the Cotton Boll Weevil, is between the budding and the squaring stages. Any poison applied after the plant has formed squares is of no use against the weevil for the reason that once the square is formed, the insect feeds within it and hence does not come in contact with the poison.

Experiments have recently been conducted with powdered arsenate of lead as a new poison for the Boll Weevil. Great hopes are entertained by Prof. Wilmon Newell, of the State Crop Pest Commission of Louisiana that this poison will prove to be satisfactory. If these hopes are realized, arsenate of lead may possibly be of use to fruit-growers and gardeners in the North.

He next showed some specimens of the Fire Ant (*Solenopsis geminata*), which is so useful in excavating the larva of the Boll Weevil from the square; the Argentine Ant which is causing much consternation in the households of the South; the Texas Fever Tick and a parasitic fungus on the White Fly (*Aleyrodes*).

HYDROECIA MICACEA, ESP. IN CANADA.

By Arthur Gibson, Central Experimental Farm, Ottawa.

Of recent years much attention has been paid, by several entomologists, to the boring larvæ and the perfect moths of *Gortyna*, *Hydrœcia* and *Papaipema*. In Canada, the best work on these interesting insects has been done by our esteemed member, Mr. Henry H. Lyman, of Montreal. In the United States, our friend, Mr. Henry H. Bird, of Rye, N.Y., has carefully studied the life-histories of many species, probably the most of which have been described as new to science.

The larvæ of some of the moths of this group are, more or less, of economic importance. The Hop Vine Borer, *Gortyna immanis*, Gn., is well known from its ravages in hop yards. In the annual report of the Dominion Experimental Farms for 1892, Dr. Fletcher treats of this insect at considerable length and gives the life-history. The Columbine Borer, *Papaipema purpurifascia*, G. & R.,* is recorded as a destructive enemy of cultivated plants of the genus Aquilegia. The Stalk Borer, *Papaipema nitela*, Gn., is widely known from its attacks on potatoes, tomatoes and corn. The

*Report, Ent. Soc. Ont., 1904, p. 81.

Burdock Borer, *Papaipema cataphracta*, Grt., is very common in Ontario, and is sometimes very injurious to many kinds of garden plants having thick, succulent stems. It has a wide range of food plants, but in the Ottawa district it has been found boring chiefly in the burdock.

The species, however, which I wish to call special attention to to-day is one which has been reported to the Division of Entomology, on several occasions during the last four years. Attention was first drawn to it in August, 1905, when, early in the month, Mr. George Welch, of Westport, N. S., wrote asking for information as to how to destroy worms which were boring into the pods of his garden peas. He said that the worms were large and quite plentiful. Not recognizing the enemy, Dr. Fletcher wrote asking for specimens. Under date of August 31st, Mr. Welch sent two caterpillars, all he could find at that date, and mentioned that after the end of July they were not so plentiful. One of the larvæ, unfortunately, had died during transportation and the other specimen had changed to the chrysalis state. From this latter a perfect specimen of the moth was reared on Sept. 18th.

On July 13, 1906, Dr. C. A. Hamilton, of Mahone, N.S., forwarded a caterpillar which he had found in a corn stalk. Only one larva was found on that date, but Dr. Hamilton said that other plants had withered away, probably from the same cause. This caterpillar pupated on July 19th and the moth emerged on August 7th.

In 1907, another single larva was received, on July 12th, from Mr. Capel B. St. George, of Tramore, Ont., who stated that he had found it boring in corn in his garden. The moth from this specimen emerged on Sept. 6th.

On June 30th of the present year, Dr. Hamilton forwarded another specimen from Mahone, N.S., which he had found in corn. The moth emerged on August 6th. A larva had also been found a few days previously, but unfortunately had been lost, and a further plant was seen to be injured, but the caterpillar could not be found.

In the collection of insects of the Division of Entomology at the Central Experimental Farm, are two specimens of the moth, which were taken at St. John, N.B., on August 29, and September 12, 1902. These were sent to Dr. Fletcher under the name of *Gortyna medialis*, Sm. In Mr. McIntosh's list of the noctuidæ of New Brunswick,[1] the following note appears:

"*Hydræcia medialis*, Smith: one taken September 2nd, (1898)." In Dr. Fletcher's Entomological Record for 1903,[2] this moth is recorded as having been "very abundant, August and September, St. John, (McIntosh)." From this statement, and in view of the above occurrences at Westport, N.S., it will be seen that this insect is not uncommon during some seasons in the Maritime Provinces. The record of this insect having been found at Tramore, Ont., is very interesting. While the presence of isolated individual larvæ in corn, or other plants, is of no economic importance, still as shown above, the insect has on occasions been noticeably destructive. The habit of the caterpillars boring into the pods of garden peas, as observed by Mr. Welch, is certainly remarkable and is the only instance known to the writer of a larva belonging to this group boring into anything other than a stem or a root.

[1]The Noctuidæ of New Brunswick. Reprinted from Bulletin of the Natural History Society of New Brunswick, (St. John) No. XVIII., 1899.

[2]Report of the Entomological Society, 1903.

The following description of the caterpillar was taken from the specimen received from Dr. Hamilton in July, 1906:

Length, 32 mm. Head, rounded, chestnut brown, shining, mouth parts darker. Body: a dirty, creamy colour, with a pinkish tinge on dorsum, except at intersegmental folds. Thoracic shield pale brown, margined anteriorly with dark brown. Tubercles pale brown, each with a single pale hair. Tubercle IV on seventh abdominal segment is almost as large as the upper half of the spiracle, the upper edge being slightly above the upper edge of the spiracle. Spiracles black. Anal shield blackish. Dorsal vessel distinct. No markings whatever on the body. Feet all pale.

A description of the larva from Mr. St. George was also taken, but the only differences which my notes show, are that the thoracic shield was margined in front with black, and the body noted as being greenish-white with a rosy tint above spiracles except at intersegmental folds.

The moth reared from garden peas from Westport, N.S., was submitted to Mr. Henry Bird, who reported upon it as follows: "The Nova Scotian specimen looks like *medialis*. A series might be quite convincing." As this left some doubt about the exact determination of the moth, a specimen was sent to Sir George Hampson, of the British Museum, who determined it as *Hydrœcia micacea*, Esp., with the statement that it was "exactly like European specimens."

In Miss Ormerod's Report for 1898, an account of injury to potatoes by *Hydrœcia micacea* is given, under the popular name of the Potato-stem Borer. This outbreak which occurred at Fyvie, Aberdeen, Scotland, is described as having been destructive to the growing crop of potatoes, especially in gardens. The injury had been noticed every season for some years and a careful examination invariably showed that the damage had been done by the borer. Miss Ormerod quotes from Mr. Richard South: "This species is known to feed in larval stage in Dock and species of Equisetum." In Stainton's "Manual of Butterflies and Moths," vol. 1, p. 198, the larvæ are said to feed "in the roots of various Cyperaceæ." In Kappel and Kirby's "British and European Butterflies and Moths," it is stated that the larva "lives in the roots of *Glyceria spectabilis*, Iris, etc."

The moth which is known as the Rosy Rustic is stated to be "common and widely distributed in Central and Northern Europe in August and September." Miss Ormerod says: "The moth is from an inch and a quarter to a little over an inch and a half in expanse of the forewings, which are variously described as of a pale brown ground color with a rosy tinge, or of a 'rich, reddish brown'; on the wing is a 'broad dark patch', otherwise described as a 'broad median band', the outer portion being 'very rich, dark brown'. Hind wings 'whitish grey with darker central line', or 'dingy grey brown with a darker crescentic discoidal spot and transverse median bar'; the antennæ nearly white."

The above occurrences of *Hydrœcia micacea* in Canada are, as far as we know, the only American records of this insect.

FURTHER NOTES ON THE COCCIDAE OF ONTARIO.

By Tennyson D. Jarvis, O.A. College, Guelph.

In last year's Annual Report, I gave an account of forty-eight species of Coccids for Ontario. Further collections and investigations have enabled me to add the following to the list.

Kermes galliformis (Riley), Red Oak, Toronto.

Saissetia hemisphaericum (Targ), Cotton, etc., Conservatories in most parts of Ontario.

Aspidiotus abietis (Schr.), Hemlock, Guelph.

Chrysomphalus aonidum (Linn.), Ficus elastica, Conservatory, Guelph.

Ischinaspis longirostris (Signoret), Palm, Conservatory, Toronto.

Undetermined Species of Pseudococcus.

On bark of Apple—*Pyrus malus*, Guelph.
" " Hawthorn—*Crataegus sp.*, Guelph.
" " Horsechestnut—*Aesculus hippocastanum*, Guelph.
" " Beech—*Fagus ferruginea*, Guelph.
" " Willow—*Salix sp.*, Guelph.
" " Lombardy Poplar—*Populus italica*, Guelph.
On leaves of Soft Maple—*Acer saccharinum*, Guelph.
" " Willow—*Salix sp.*, Guelph.
On roots of Raspberries—*Rubus strigosus*, Muskoka.
" " Blueberries—*Vaccinium Pennsylvanicum*, Muskoka.
" " Goldenrod—*Solidago canadensis*, Guelph.
" " Yellow Avens—*Geum strictum*, Guelph.
" " Yarrow—*Achillea millefolium*, Guelph.
" " Wormwood—*Artemisia sp.*, Guelph.
" " Ox-eye Daisy—*Chrysanthemum leucanthemum*, Guelph.
" " Daisy Fleabane—*Erigeron philadelphicum*, Guelph.

Kermes galliformis (Riley).

These scales occur either singly or in clusters on the twigs and branches of Red Oak (*Quercus rubra*). The form of the adult female puparium is globular with a slight incision for insertion on the stem of the food plant.

It is nearly smooth and somewhat shining. The colour is white and beautifully variegated with yellowish, gray and black. Mr. A. Cosens found this fairly common on Red Oak at Toronto.

Saissetia hemisphaericum (Targ.)

The adult female varies from light to dark brown, frequently shaded with darker brown to black.

It is more or less hemispherical or slightly elongate and convex. The surface is smooth and shining to the naked eye but with higher magnification is seen to be thickly studded with little dots. The immature female is usually of a pale yellow with a well defined central and two lateral carinae. It is a very common scale in conservatories throughout Ontario.

Aspidiotus abietis (Schr.).

Puparium of the female oval or elongate oval and the side next the midrib compressed and straight. About 1.5—2 mm. long and 1—1.2 mm. wide. Colour dark brown; back convex. Exuviae central, dull yellow. Common at Guelph on Hemlock (*Tsuga occidentalis*).

Chrysomphalus aonidum (Linn.).

Adult female puparium circular and somewhat convex. Colour reddish brown, turning paler towards the margin. Exuviae central, dark orange and nipple-like. It has been found in the conservatory at Guelph on *Ficus elastica*.

Ischnaspis longirostris (Signoret).

The puparium of the adult female is very long and narrow. Back shining black; exuviae orange coloured. A few specimens were found in a Toronto conservatory.

Distribution of San Jose Scale (*Aspidiotus perniciosus*) in Ontario.

The San Jose Scale is slowly gaining ground in Ontario. The most northern point of infection is at Lorne Park, County of Peel on the northern shore of Lake Ontario.

Fig. 6. The shaded portions of the map shew the counties of Ontario in which the San Jose scale is now established.

Three New Host Plants for Eulecanium Caryae in Ontario.

Rock Elm (*Ulmus racemosa*), Hornbeam (*Ostrya virginica*), Blue or Water Beech (*Carpinus caroliniana*). We have now five host plants for this scale in Ontario.

A New Host Plant for E. Fletcheri in Ontario.

This year *E. Fletcheri* was found at Guelph on Red Cedar (*Juniperus virginiana*).

One Brood for the Pine Scale (*Chionaspis pinifoliae*) in Ontario.

This scale passes the winter in the egg stage. The eggs hatch in the early part of June and the female reaches maturity about the middle of August when she lays her eggs which do not hatch until the following year.

SOME ENEMIES OF ONTARIO COCCIDAE.

By J. W. Eastham, Ontario Agricultural College, Guelph.

Leaving out our wild birds, upon which I have nothing to say, the enemies of Scale insects or Coccidae may be divided into three classes, namely:—

1. Predaceous insects;
2. Hymenopterous parasites;
3. Fungus Diseases.

Amongst predaceous insects the members of the family Coccinellidae or Ladybird beetles are by far the most numerous and most important. Of these insects one of the most beneficial is *Hyperaspis signatus*—a small black beetle with a small red spot on each elytron. The larvae of the species of Hyperaspis do an immense amount of good by destroying large numbers of the egg sacs of the Cottony Maple-scale (*Pulvinaria innumerabilis*). The larvae are large, white and mealy, and much resemble certain species of Dactylopus, for which they might easily be mistaken by a casual observer. The larvae pass from one ovi-sac to another, devouring the eggs as they pass along, but leaving the ovi-sac apparently little the worse externally. During the summer fully 80 per cent. of the ovi-sacs of Pulvinaria in the vicinity of Guelph were destroyed by the Hyperaspis larvae.

Another very common and important species is the Twice-stabbed Lady-bird (*Chilocorus bivulnerus*), Fig. 7, the adults and larvae of which are to be found feeding on no fewer than seven species of scales in this neighbourhood. Its special favourites, however, are the Oyster-shell Bark-louse and Curtis Scales, on both of which it is usually quite common. It is interesting to note that the larvae of this insect are preyed upon to a considerable extent, by Lace-wing fly larvae (*Chrysopa*). Figs. 8 and 9. Another species which preys more especially upon *Eulecanium cerasifex* is the 13-spotted Lady-bird (*Hippodamia 13-punctata*), Fig. 10. These larvae are very thorough in their work as they devour everything but the body walls of the scale.

Another common predaceous insect is a small mite *Monieziella, sp.* which is generally found feeding on the Oyster-shell Bark-louse and Curtis scale, especially the former; it is also found feeding on the eggs of *E. cerasifex* but not to any great extent.

Another predaceous insect occasionally to be found is a Lepidopterous larva which eats its way through the cottony masses of *Pulvinaria innumerabilis*, and in this way one caterpillar can destroy many scales. Although several attempts were made I was unable to rear the adult; but in all probability it is the larva of *Laetilia coccidivora*, Comst., an insect whose larvae prey on Pulvinaris to a considerable extent in some parts of the United States.

Turning next to the Hymenopterous parasites, we find that in this district they belong entirely to two sub-families of the Chalcididae or Chalcis Flies—the Aphelininae and Encyrtinae. These two families are readily

distinguished from each other by the fact that members of the Aphelininae have 8-jointed antennae, a divided meso-pleura, and the middle tibiae are not specially adapted for saltatory purposes. The Encyrtinae, on the other hand, are characterized by the large saltatory spine of the middle tibiae, which is generally long and stout, though less frequently it is found dilated at the base, and armed with a double-row of black teeth or spines. This last feature readily marks off Encyrtinae, as no other family, as far as I am aware, possesses this large saltatory spine.

The Aphelininae are generally parasitic upon the Aleyrodidae or, amongst Coccidae, upon members of the sub-family Diaspinae. The commonest member of this family is *Aphelinus mytilaspidis*, a small yellow parasite which attacks several species of scales but principally the Oyster-shell Bark-louse. The larva feeds on either the scale body or eggs according to the time of the year; but like most Aphelinids there is not usually more than one larva to a single scale. The larvae, when full grown, are about 1 mm. long and very stout, being almost as broad as long; the pupae, stout, dark and contracted.

It appears to be double brooded as the adults were reared at the beginning of June and end of August; the adults may be usually observed ovipositing on the young scales during June. Another closely related species

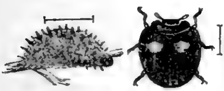


Fig. 7. Twice-stabbed Ladybird, larva and beetle.

Fig. 8. Lace-wing fly and eggs.

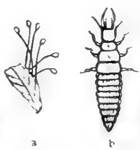


Fig. 9. Lace-wing fly eggs and larva.

Fig. 10. Thirteen-spotted ladybird.

is *Aphelinus fuscipennis* which attacks both San Jose and Curtis Scales. This parasite is widely distributed, one being common on San Jose Scales in some parts of the United States. It differs from the preceding species in having slightly clouded wings.

Another very important member of this family is *Coccophagus lecanii*—a small Chalcid with yellow markings upon the meso-scutum and scutellum. It is this parasite, acting in conjunction with *Hyperaspis signatus* mentioned previously, which so effectively controls the outbreak of Cottony Maple Scale (*Pulvinaria innumerabilis*). It is amongst the Encyrtinae, however, that we find the most important Hymenopterous parasites of the Coccidae. During the last summer some twenty species of parasites belonging to this family were reared by me from various scales—but principally from the various species of Lecanium. No fewer than ten of these species, or 50 per cent. were reared from one species of scale, namely *Eulecanium Fletcheri*.

The most common of the Guelph representatives of this family belong to the genus Comys, of which three species are found in this neighborhood.

Comys scutellata is a large, handsome species which parasitizes *Eulecanium caryae* to such an extent that few scales escape. It is probably a European species, accidently introduced and now widely distributed in North America. *Comys fusca*, a closely allied form, is very common around

Guelph parasitizing the New York Plum Scale (*E. cerasifex*). It is this parasite which is so effective against the Brown Scale in parts of California.

Other common genera belonging to this family are Blastothrix, Chiloneourus and Encyrtus all of which are found on the Lecaniums of the district. No fewer than 41 specimens of an Encyrtid were reared from a single scale of *Kermes pubescens*, an occurrence which seems to indicate that polyembryony exists, at least among some of the Scale parasites: as it seems incredible that 41 eggs would be deposited in a single scale.

Coming to the fungus enemies we find on record several species from various parts of Ontario, only two of which I have found in the vicinity of Guelph. Of these two *Cordyceps clavulata* is by far the more abundant. It is, however, of not much economic value as it does not appear till late in the season—this year it was nearly the end of July. It attacks chiefly *E. cerasifex* but also *Fletcheri* and occasionally *E. caryae*.

The other fungus is known as *Microcera coccophila* and attacks the Curtis Scale—the attacked scales being entirely destroyed. The small red fruiting bodies of this fungus only appear after rain, disappearing again within the space of a few hours after the rain ceases, and consequently, since the spread of this fungus appears to be dependent upon rain, it is not of any great economic importance, at least in this part of Ontario.

"SOME BEETLE HAUNTS," BY AN AMATEUR BOTANIST.

By F. J. A. Morris, Trinity College School, Port Hope.

In my four seasons of collecting, as a coleopterist, there have been three collecting grounds that have most attracted me: (a) Stumps and tree trunks; (b) Blossoms; (c) Foliage. In all three I have found a considerable range of beetle-guests and am able to record rare or interesting finds. It is probable in the second of these three haunts that I have had most success, but it is with the first that I intend chiefly to deal in this paper.

There are two conditions under which stumps make a good collecting-ground; one is when they are dead and dry, but have the bark still covering them; it was this condition that first drew my attention and held it through my first season as a collector. The other condition is when there is yet some life in the wood so that the top of the stump bleeds. I have found that stumps ooze sap in this way for several seasons after the tree has been cut down. A good way to catch beetle-visitors is to scatter some good sized chips or lay a slat or two of wood or bark on the top. Most beetles are active at night, and when there is a shelter of this sort, they take cover there instead of flying away when the sun rises. Easily the best tree for its range of beetle visitors, as well as for total quantity, I have found the basswood; next to that the white pine: then the maple, the birch and the elm. Often when a stump is dry and apparently not in a condition to attract guests it may be made inviting if the bark is still partly green. I have often pried up the bark with a chisel and laid the strips thus removed on the top of the stump; the smell of the sap or juice fermenting has generally lured some prizes to this bait and trap combined.

The season for collecting in this way may be said roughly to extend from the beginning of May to the middle of July. I began collecting in the spring of 1905, but as I went to England at the end of June I did not make much headway that season. In 1906, however, I did a great deal of collecting and gained quite a lot of experience. One of my first finds was

at the beginning of June while prying the bark from a basswood stump. I discovered something like a dozen specimens of *Saperda vestita*, newly hatched and buried in the inner bark of the tree. I had my killing bottle with me, but as the insects were still soft I put them into a small tin box. Here they crawled about excitedly, squeaking (or rather, stridulating) when

Fig. 11. Dicerca divaricata.

Fig. 12. Cicindela sex-guttata.

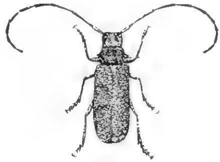


Fig. 13. Monohammus scutellatus.

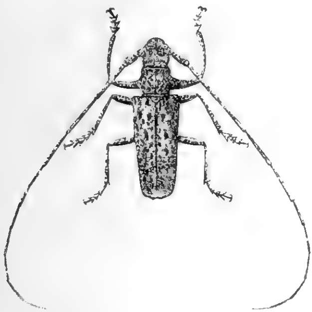


Fig. 14. Monohammus confusor.

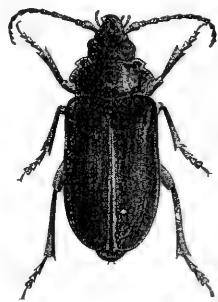


Fig. 16. Prionus laticollis.

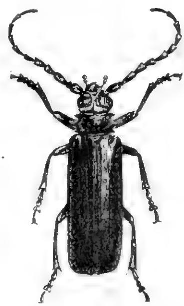


Fig. 15. Orthosoma brunneum.

handled. On examining them after my return home, I found they had fought in the box, two of them had had their antennae nipped off and several had been deprived of their full complement of legs. I had not yet learned the advantage of laying the detached bits of bark on the stumps as shelter

for nocturnal visitors and so missed a golden opportunity. However, there were a number of basswood stumps in the clearing where I made my first capture and from these I got several more specimens.

About the last day of June in the same season while struggling from a tamarack swamp in which I had found a rare fern (*Botrychium simplex*), I noticed a falling and decaying trunk of elm and on removing some bark I found it infested with a larva closely resembling that of *Saperda vestita;* I took one that appeared nearly full grown, with some of the rotten inner bark, and succeeded in rearing it; some three weeks later it emerged from the pupa as the elm-borer (*Saperda tridentata*). I have taken only one other specimen of this beetle; it settled one fine Sunday night in June on a supper table at which I sat, a guest; the entomologist, however, would not be denied, and in spite of looks of outraged propriety on the part of my fellow guests, and some embarrassment (not mine, but my hostess'), I produced a cyanide bottle and captured the insect.

Early in July I went to Oliver's Ferry, on the Rideau, and in a day or two chanced upon a spot that proved a regular treasure house to the young collector; it was at the side of a path through a wood of young growth, mostly basswood and maple. Here lay a log of basswood with the bark still on it, close by the stump from which it had been cut, and a pile of basswood split and stacked. In the bark of the stump and the log I found larva and pupæ of the *Saperda vestita;* some pupæ that I took home lived and from two or three I secured specimens of the imago. In the hot sunshine beetles lit on the log and on the wood pile, and I tried the experiment of laying detached pieces of bark on the stump, the log, and the split wood; sometimes sandwiching bits of bark between sticks of the wood pile. This simple contrivance of bait and trap yielded splendid results for over a week, at the end of which time the bait was filched by the sun drying all the moisture out. My captures comprised an Elater as large as *Alaus oculatus* and dark pitchy brown in colour; two specimens of a *Chalcophora*, 3 or 4 of *Dicerca divaricata* (Fig. 11), and 15 of a *Chrysobothris* about the size of the apple borer (*Ch. femorata*); a dozen or more of a blackish weevil akin to the strawberry weevil, some two dozen specimens of *Eupsalis minuta*, sexes evenly divided 25 specimens, of *Parandra brunnea*, one specimen of *Tragosoma Harrisii*, and a beautiful specimen of the little *Amphionycha flammata;* this last Dr. Bethune tells me, has seldom, if ever, been reported from Ontario, and it may therefore be interesting to some of you to know that I captured a second specimen of the same beetle about three days later, sunning itself on a leaf of basswood, within 50 yards of the first capture. It was a bright, calm day in July when I captured the first, and very hot with the sun almost at its zenith, and the log on which the insect lit was bathed in sunshine; small as the creature is, the sharp click with which it settled was distinctly audible. As the basswood pile was beginning to fail me, I happened on a clearing where some small maples had been felled. Finding the stumps still moist, I laid chips and bark about their tops. This yielded me several new species—a beetle marked like the *Megalodachne*, but smaller and with the ground-colour light brown instead of dark chestnut; 3 or 4 specimens of a beetle allied to the weevils, I think one of the *Anthribidae;* and, settling on a stump in the sunshine, a magnificent specimen of *Purpuricenus humeralis*, a longicorn of great beauty.

At the end of August I was out fern-hunting at Lake Dalhousie, about 20 miles north of Perth. From a stump of white pine I took the pupæ of a longicorn which later emerged as *Rhagium lineatum*, and while raising some chips from the top of a fresh and resiny stump of white pine I drove

from cover a Clerid that was then new to me; the head and thorax were dull orange, the base of the elytra the same, the rest of the elytra was alternate grey-white and black. Up to that time I had only found two species—a small scarlet one, fairly common, under bark, and one banded with orange and dark blue, which is frequent on certain blossoms. Early next spring, about April the 28th, I found some white pine had been felled in the winter, not many miles from the school in Port Hope. Recollecting my find of the previous autumn, and thinking the fresh resin might be the attraction, I laid some bits of bark and chips on the surface of the stumps. On visiting my traps a day or two later I was agreeably surprised to find 3 specimens of the resin-loving Clerid. About the same time I got 5 more specimens from newly-felled pine, under the chips that had been left on the stump by the axe. Some of these stumps I baited with chips and in all captured about a dozen. I have never found them on dry stumps, but only under fresh chips and associated with new resin. The creature closely resembles a beetle, figured by Curtis in his British Entomology as *Thanasimus formicarius*. It is there said to frequent the Scotch fir, which, of course, is also a pine.

About the middle of May in the same season (1907), I visited the basswood stumps from which the year before I had got the *Saperda vestita*. Some of the bark that I pried up was infested with *Leptura ruficollis*, and I took also from under the bark two pupae of a longicorn closely allied to *Urographis*. Ripping some bark from the sides of several stumps I laid it on the tops. This proved an admirable bait, and among my captures were 3 or 4 specimens of a tiger-beetle (*Cicindela sexguttata*), Fig. 12, 7 specimens of a rove-beetle (*Staphylinus violaceus*), 12 or 14 of the northern Brenthid (*Eupsalis minuta*), a single specimen of a locally rare darkling beetle *Phellopsis obcordata*), 5 Penthes and 6 or 8 *Alaus oculatus*. I may say that I have found the species *oculatus* very common on the basswood, and in one or two cases the beetle, under concealment of the strips of bark, had during part of the night half buried itself in the wood of the stump. The beetle can eat very fast. A friend of mine took 9 or 10 from a rotten basswood log and sent them to me in a stout cardboard box. When I got the parcel, one of the largest specimens had eaten a hole through the corner of the box and was through two folds of the brown paper wrapper. I have never found the allied species of *myops* on basswood but always in white pine, usually under the bark of dead, dry stumps where it is fairly abundant.

Later on in the same season, while wandering about the upper reaches of Gage's Creek, about 6 miles from the school, I passed through a clearing in which hemlock had been felled. Among several other Buprestids settling on the bark of prostrate logs as well as standing trees, were two that were new to me, both very active and only to be caught (unless you had a net) by careful stalking—one a small *Chrysobothris* and the other *Melanophila Drummondi*. This last I had never seen before and have never seen since, but on this newly-felled hemlock, as well as on living trees, it was abundant, and I captured about a dozen specimens. A few days later, at the end of June, I took to the clearing a brother-collector anxious to see *Melanophila Drummondi* in its native haunt, and there I turned him loose. While I was looking about with my eyes focussed for beetles, I distinctly saw a pair of longicorns running on the trunk of a tall elm growing at the foot of the clearing near the stream. From their movements and appearance both I felt sure they were longicorns and at first took them for a pair of *Cyrtophorus verrucosus*, a beetle I am well acquainted with. An instant's reflection told me that at ten yards' distance a beetle the size of *Cyrtophorus* would hardly be visible, and I rushed towards what I was certain must be a prize. Unfor-

tunately the beetles were running in an upward spiral and when I stumbled to the tree over a rotten log they were almost out of reach. I jumped and managed to brush one to the ground, but could not see it by the most careful search. However, I waited patiently for a minute or so, and then to my great delight saw the creature emerge from the ground and re-ascend the trunk. As I captured it I recognized in it the *Physocnemum brevilineum*, a long-coveted species. Scanning the tree carefully I presently descried 2 more of the beetles running about on the bark, some 20 feet up. I stayed for nearly an hour at the foot of the tree, with hope in my heart and a crick in the neck, as intent as a dog listening to the clatter of a squirrel,—and my reward was three or four specimens of the beetle. As a rule, they appeared at a height beyond range, on the trunk of the tree, walking rapidly downwards, following the corrugations and grooves of the bark. Occasionally, however, they lit on the tree after flight through the air, but they rarely, when disturbed, took to the wing for escape, preferring to run or to release their hold and drop. A six mile walk is nothing when a new longicorn is waiting just around the last corner and I made the tree the turning post of my daily course for nearly a week, by which time I had taken 15 or 16 specimens. The tree was apparently sound, with a magnificent crown of foliage surmounting the massive pillar of its trunk, but the beetle was breeding there. I am pretty sure, and in July of this year, while I was in England, my fellow-collector got several more specimens on the same tree.

Early in July I made an expedition to Garden Hill, some ten miles north of Port Hope. Here they were cutting out the pine from a 20-acre lot and a saw mill was at work. I went out in hopes of getting some specimens of *Monohammus*, a beetle that with a single exception I knew only from cabinet collections. The lumbermen said they had seen numbers of these insects on the logs and in the brushwood, but from inexperience, or ill-luck, I failed to secure many; my bag included one pair of the large grey *Monohammus*, 3 isolated specimens of *Monohammus scutellatus* (Fig. 13), and one specimen of a third species of *Monohammus*, the elytra being in colour a mottle of three or four shades of rust yellow, and the insects in size almost identical with *scutellatus*. By preparing several stumps and logs with chips and stripping the bark from dead trees I got several other longicorn beetles, such as *Criocephalus agrestis*, *Orthosoma brunneum* (Fig. 15), *Tragosoma Harrisii*, and a carcase of *Prionus laticollis* (Fig. 16). Had this been all I would have felt some disappointment, but it wasn't. The place was a veritable paradise of Buprestids, and not only did I get 12 or 14 species in all, but among them several quite new to me, beginner as I was. There were at least two (probably three) species of *Chrysobothris*, two of *Chalcophora*, three or four of *Dicerca*, two or three of *Buprestis*, and a black *Melanophila* with a nasty bad habit of settling on the back of one's neck and giving it a sharp nip.

There could be nothing more enjoyable than roaming about in that clearing, and though it is nearly a year and a half ago, it seems like yesterday. It was glorious July weather. In the distance you could hear the Mourning Dove, and round about in the brushwood and trees were several pairs of Towhees and not a few slate-coloured Juncoes. While ranging up and down, I noticed on a bare, dead trunk of pine a bright looking beetle with apparently a damaged wing, for it stood out from the creature's body at an angle. At nearer view this resolved itself into a brand new Clerid, the largest I had ever seen, and in its jaws was the elytron of an *Elater* off which the monster had just been dining; no midnight assassin, but a cannibal in broad daylight, and the rascal was flaunting his trade in one of the gayest liveries you ever

saw; the head and thorax were orange, the shoulders (or base of elytra) black, round the waist a broad sash of brilliant scarlet, below that another band of black, then a band of grey-white, and the tips of the elytra black. In two all-day visits to this place I caught five of these beetles, three of them red-handed—one on a stump with an ant in its jaws, a third on a fence-post dissecting a grub of some kind, the other two belonged to the blameless order of those who have not yet been found out. One was resting on a rail along which a stream of ants happened to be crawling, and the fifth was just issuing from an ant bore in a dead pine, down which motives of curiosity, doubtless as innocent as idle, had prompted it. The same impulse, I think, rather than any misgivings about my intentions, caused it to disappear down an adjoining tunnel, whence my forceps finally extracted it.

In the season just over (1908) I noticed some felled maple and birch on a hillside 7 miles from Port Hope. At the beginning of June I laid chips about two or three of the stump heads: on the fallen trunks I found an immense number of *Chrysobothris breeding*, while under two of my chips on the maple I took two pairs of *Urographis fasciata*, and resting on a stump near by I captured a *Leptura biforis*.

About the middle of June my attention was drawn to some white pine felled in the winter among some woodlands, known locally as Pine Grove. There were about eight trees in all, lying on the ground within a space of about a mile. On the trunks and branches were crawling a number of small dark Clerids with a mark of crimson and two marks of white on each elytron; there was also two sorts of weevil abundant under chips of wood on the ground, and many Buprestids visiting the logs; but in especial, on the trunks, limbs and larger branches there were *Monohammi* breeding. In about six visits I took well over 100 specimens, and my fellow-collector continued to find longicorns up to the 20th of July or later. Our combined captures would amount to 250 beetles. The great majority of these were *Monohammus scutellatus*, of which I took 100, mostly in pairs. I took besides 8 or 10 specimens of the large grey *Monohammus* (whether *titillator* or *confusor*, Fig 14, I am not sure), and four of both sexes of the rust-yellow species. We also got several specimens of a stout grey beetle resembling *Urographis*, but without the extended ovipositor, and a few of a grey species of delicate structure and extremely fine antennae (perhaps *Liopus*). About the middle of July my friend took some 12 specimens of *Leptostylus parvus*. All this on some ten trunks of newly-felled pine.

Our experience raises a question as to the length of time required by the larvæ to mature. There was a tree among these others that had been blown down early in 1907, and was thus in its second season. It was full of holes, most of them quite fresh, from which mature insects had escaped. We could hear larvæ at work during June inside the log, but we did not see any beetles breeding or laying eggs on the bark, as they were doing on all the fresh-fallen trees. Unfortunately, most of these trees have since been removed. I am inclined to think that the dryer the wood is, the longer the larva takes to reach its full growth, and that if the larva hatches in fresh wood it can mature in a single season. I should think this was true of the *scutellatus*, anyway, even if *confusor* and *titillator* require longer. The well-known stories, most of them authentic, about the mature insect escaping from tables and chair legs several years after the manufacture of these articles, would thus illustrate an exceptional state of things in which the larva was confronted prematurely with dry wood to feed on.

Besides these captures on stumps and logs, I have made several by using a similar trap with fungus substituted for bark. But at present I shall

content myself in my closing paragraphs with a few general remarks on the subject of blossoms, as a collecting ground for beetles.

If you refer to any handbook of North American flora, you will find about 130 natural orders of flowering plants. The vast majority of these, however, do not offer their sweets (or pollen, rather) to those browsing cattle among insects, the beetles, whose short jaws and general habit incline them to visit only small shallow blossoms growing in close clusters (racemes) or in flat bunches or heads. Nearly all the blossoms that form a favourite haunt for beetles are included in the series between order 25 and order 50, beginning with the sumach and the vine and ending with the composites. The only important beetle-food outside that series in my experience, is the milkweed and its ally, the dogbane, which come about No. 70 in the natural orders.

If you look a little more closely at the series from 25 to 50, you will find these fall into two distinct groups of eight, separated from each other by a wall of 10 consecutive orders unattractive to beetles.

The first group extends from the poison ivy and the grape vine, through the New Jersey tea and the spiked maple to the great rose family. Of these, the milkwort and the vetch, from the form of their blossoms, are valueless; the poison ivy and the grape vine are fairly good, but the range of their guests is limited. The New Jersey tea is a plant with hardly a rival, both for range of species and for total number of insects. The spiked maple is also a rich storehouse of beetles. In the rose family I have found the hawthorn best, next to it the rose and the bramble, and then the spiræa and the choke cherry.

The second group of eight begins with the umbellifers, and passing through the dogwood and the elder, closes with the great composite family. Of these the bed straw, valerian and teasel, are comparatively worthless; but the dogwood is an excellent host and so are the two species of elder, while several of the composites are worth careful scrutiny.

I shall carry this principle of selection a little farther, by giving a rough outline of a season's beetle collecting from blossoms. The first blossom to open is the early or red-berried elder (*Sambucus pubens*). It varies considerably from season to season, as well as in any one season, owing to differences of location; but about the 10th of May it will be found flowering and its season may last for ten days. It is immediately followed by the hawthorn, which lasts till, perhaps, the 10th of June. By this time the spiked maple and the dogwoods are in flower, and before this last is over comes a riot of blossom, for the late elder and the New Jersey tea both open in the last days of June.

These blossom haunts, then, extend from early in May till the middle of July. The only other conditions of time that need be mentioned are that the pollen on a given blossom must be in a certain state of ripeness or it does not appear to attract beetles at all, and, as a rule, the sun must be shining on the blossoms. If it is hot and calm besides, then you have ideal conditions.

There is, however, an important condition of space to add to these of time. I have, as a beginner, spent hours in fruitless search over whole hedges and thickets of elder and bushes of hawthorn, when ten minutes at a single shrub with only a few meagre blossoms on it would yield a rich harvest. Why? Because the flowers must be growing near a thicket or a wood. If they are in the open, even a hundred yards or so from timber lands, they are almost useless. This is particularly the case when it is longicorns you are on the look-out for. It is, of course, well-known to coleopterists of experience that a clearing or the border of a wood is the best

locality. It is remarked again and again by Bates in his travels on the Amazon, and it is pointed out by Rye and Fowler in their hints to collectors in Great Britain.

In closing I should like to say that by no means the least pleasure to a lover of nature is to observe the marvellous constancy with which season after season these tiny creatures, the offspring of a last year's brood, return to their ancestral haunt, be it blossom or leaf, true to the clock of the year, almost to a day; in obedience to a law there is no gainsaying, and which yet in the creature's serene unconsciousness seems robbed of any touch of harsh compulsion.

TWO ADDITIONS TO THE LIST OF BUTTERFLIES OF THE ISLAND OF MONTREAL.

By Albert F. Winn, Westmount, P. Q.

One of the great attractions of collecting Butterflies and Moths lies in the probability of coming across, at any moment, something new to the locality in which one is working, even though common elsewhere.

Although the district about Montreal has been fairly well worked ever since the formation of the Montreal Branch of the Entomological Society of Ontario, 35 years ago, not a season passes in which we do not find some moths large or small not previously observed and recorded. But finding a new butterfly is a different matter and it was indeed a pleasant surprise when I came across a specimen of the little pepper-and-salt Skipper, *Amblyscirtes samoset*, Scudder, flying over a very muddy field at Pt. aux Trembles, near the rifle ranges on June 7th, and a few minutes later I took another. My companions also wanted some and a thorough search was made, resulting in Mr. Chagnon also capturing one in an adjoining field. The species is apparently commoner to the north among the Laurentian Mountains, where I have taken it at Montfort and St. Faustin, and also at Calumet on the Ottawa River—always in early June.

A month later—July 12th—while walking across the Westmount Golf Links, with Mr. A. R. M. Boulton, of the Quebec Branch, a small yellow butterfly passed us, which looked like a very much undersized *Colias philodice*. My net was not ready, so my companion offered to catch it for me if I wanted it, but as the day was very warm I said not to chase it as it would probably come back, but it kept straight on. We went the opposite way, to the Nun's Woods at Cote St. Luc, to look for *Haploa confusa*, Lyman, and were busy catching a series of these moths, when another of the little yellow butterflies came along. I was ready this time and in a moment secured the first specimen of *Terias lisa*, Bd. and Lec. (the little Sulphur, Holland aptly calls it) that I had seen alive. Another soon appeared in the same place and Mr. Boulton captured it. As we were close to a fine field of clover we thought the butterflies were probably coming from it and therefore turned our attention to it, but without seeing any more. We resumed our raid on the Haploas, going further into the woods where *H. confusa* was scarcer and *H. Lecontei* more likely to be found. We were again lucky, for on coming out of the woods on the west side into a small cedar swamp another *Terias lisa* was flitting about, which I easily caught. As no more were visible we adjourned to Cartierville for lunch.

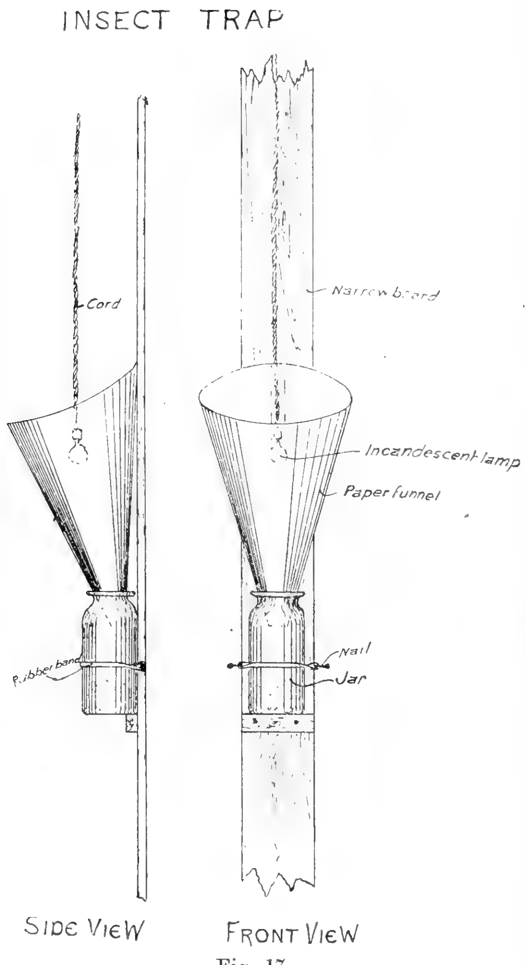

INSECT TRAP
Cord
Narrow board
Incandescent lamp
Paper funnel
Nail
Jar
Rubber band
SIDE VIEW
FRONT VIEW

Fig. 17.

COLLECTING WITH A LANTERN TRAP DURING THE SEASON OF 1908.

By J. D. Evans, Trenton.

The apparatus used during this season consisted of a quart gem jar charged with cyanide of potassium. The jar was prepared in the following manner, lumps of the cyanide of potassium were distributed over the bottom of the jar upon which were placed cork crumbs to the depth of about 1¼ inches—then plaster of Paris formed with water to the consistency of cream poured in to the depth of about 1¼ inches, (although a ½ inch or ¾ inch would have been sufficient.) In all other respects the trap was prepared and set up as described in the Canadian Entomologist for May, 1907. The plaster of Paris gives a better bottom and remains in better condition than the cotton batting filling as there described. This jar remained in good condition for at least three months' service, then getting weak a ⅝ inch hole was bored in the plaster of Paris and lightly stopped with a loose plug of cotton batting and a small quantity of chloroform poured into the hole by the aid of a glass funnel, a charge thus made would last for several nights.

Collecting with the trap was commenced in the first week of June and continued daily uninterruptedly until the end of September, except for a night very occasionally when it was raining—there is no record of these nights during June and July, but perhaps one night in each month would be the limit, but in August the 12th was the only exception and the 28th in September. The 4th September was a very cold night and the trap was not put out.

A daily record of the number of moths taken was not kept during June and July, but frequently the number exceeded 200 and upon one night the number was 434. During August the total number of moths taken was 2,724, the greatest number in any one night being on the 31st, when 220 were taken; the smallest number on the 24th, when 21 were taken. In September the total was 893. The largest catch being on the 5th, 160 moths and the smallest on the 15th and 19th, which were each only 2. These nights being very cool, the 29th and 30th being very cold nights nothing was taken.

Besides the moths, insects of several other orders were taken. Beetles of a considerable number of species, Hymenoptera, Diptera, Hemiptera (principally leaf hoppers of many species), Trichoptera, and Neuroptera. Upon some nights the jar would be almost full of myriads of Phrygania flies, midges, and other insects, and upon one occasion the jar was not only full but the mass extended up some distance into the paper funnel.

One might imagine that the moths would become spoiled with the multitude of occupants, but such is not the case, for many a moth was taken with its scales and fringes in perfect condition, even if in company with large beetles, such as the Lachnosternas.

With the exception of the moths, the captures in the other orders have not yet been named and listed for want of time, but with the moths there have been 281 species listed and a large number yet unnamed more particularly among the Micros.

NOTES ON THE OCCURRENCE OF LACHNOSTERNAS IN 1908.

By J. D. Evans, Trenton.

During the past nearly forty years the writer has collected Coleoptera and paid particular attention to the Lachnosternas, (commonly known as May Beetles or June Bugs), but a dozen or so specimens would be the maximum number taken in any one season and more often the number could readily be counted on the fingers of one hand. *Fusca* was considered the common species, but Dr. J. B. Smith separated and named others in the family or group *fusca* viz. *arcuata*, *insperata* and *dubia*. Since then it has been found that *fusca* is quite uncommon, the common species being *insperata* and *dubia* and the manner of separating these two species as given by the late Dr. Jno. Hamilton is the presence or absence of a tuft of hair on the head next to and between the eyes, in some specimens this tuft of hair may be much abraded.

The Lachnosternas were very numerous, this season the writer took 168 specimens either at lighted windows or in the trap, of which 91, or more than one-half of the number were *fusca*. The females of *insperata* and *dubia* are quite common, being usually about one-third of the number of the males, but with *fusca* it is very different, for the writer has never seen a female *fusca* among a large series taken at Trenton, Belleville, Sudbury and Ottawa and not until this season when one female only was taken as against 90 males. *Ciliata* is another species a few specimens of which are taken almost yearly, but yet the female has never been seen by the writer.

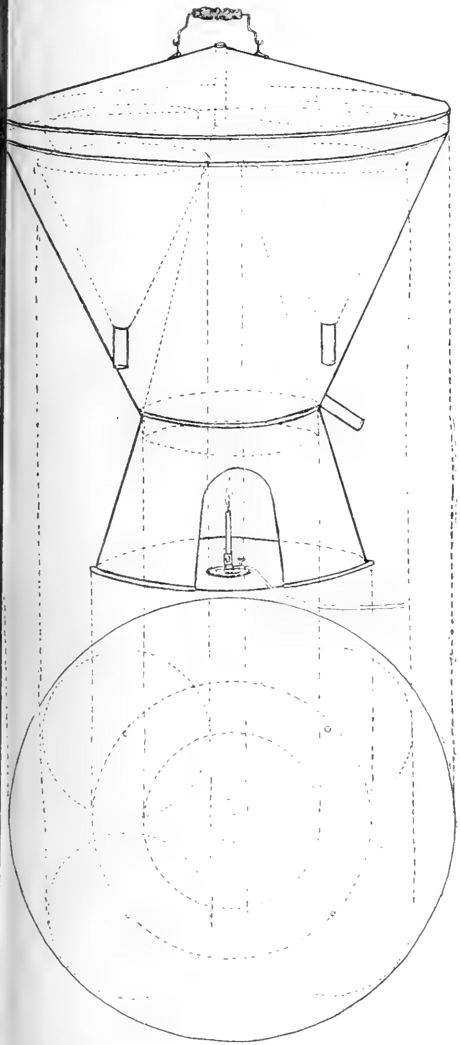
The number of specimens taken of each of the species throughout the season, being from 17th May to 6th July, is as follows: *Insperata*, 44 males, 10 females; *dubia*, 5 males, 14 females; *fusca*, 90 males, 1 female; *ciliata*, 4 males; total, 168.

In connection with this it might be mentioned that Lachnosternas occurred in large numbers this season at Gardenville and Wellington in Prince Edward County, where they have been very destructive to roots of strawberries, potatoes and other plants and in the imago state both at Trenton and Gardenville they were guilty of stripping off leaves from shrubs, raspberry canes and other fruits.

APPARATUS FOR COLLECTING SMALL ARTHROPODS TERRESTRIAL AND AQUATIC.

By Tennyson D. Jarvis, O. A. College, Guelph.

In the February number of the "Entomological News", Vol. XVII., Dr. L. O. Howard, of the Bureau of Entomology, Washington, described an apparatus, devised by Dr. Berlese, of Florence, Italy, for collecting small Arthropods and in great quantities. Being much interested in the study of Acarids our Department immediately had made an apparatus similar in structure. From it we got excellent results and a short time afterward we devised a machine for collecting aquatic insects and Acarids. We have found both collecting traps highly satisfactory. In the terrestrial trap Arthropods have been taken from many orders, but the largest numbers have been received from the Acarina, Araneida and Thysanura.



IG 18. Apparatus for collecting small terrestrial Arthropods.

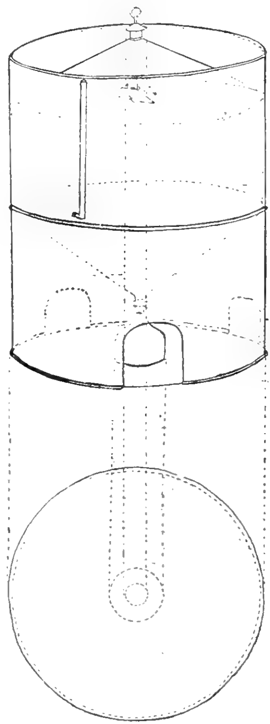


FIG. 19. Apparatus for collecting small aquatic Anthropods.

The terrestrial apparatus is made of copper, lined with tin. It consists of a central cone underneath which heat is applied. Four funnels with smooth tin lining and at the bottom of each is attached a small glass phial which may or may not contain alcohol. The funnels are surrounded by water and the water is kept hot from the gas burner below. On the top of each funnel is placed a shallow or deep tray of metallic network and on them is placed the material to be examined. The water is gradually heated and as the mites become uncomfortably hot they leave their host or other material on which they feed and travel downward into the glass tube below. If the life-history of the mite is desired, they are removed from the bottle and placed on suitable media. If the specimens are to be preserved, the tubes are usually filled with 95 per cent. alcohol or some other suitable preservative. (Figs. 18 and 19.)

A partial list of materials from which mites have been obtained is as follows:

Manure: Mites were obtained from nearly all kinds of manure and were especially abundant in horse and cow manure. From one small lot of horse manure the mites dropped down like a snow storm and filled a 4 cc. phial in a few minutes after the water was heated. Five different species were taken from this one lot.

Bark from Trees: The bark from a host of deciduous and evergreen trees were given a trial on the mite machine, and from nearly every species of tree one or more species of Acarid was taken. Many mites resemble the bark in colour or shape, on which they live, and if it were not for such a device it would mean an endless amount of waste in time and patience. A good example of this is that of a species belonging to the genus Nothrus. This mite in shape and colour resembles bits of bark or lichens.

Ensilage: A large quantity of mites were taken from ensilage from the O. A. College silo. These acarids may be largely responsible for the spread of fungus spores in the silo.

Bone: Some mites were taken from pure bone and others from bone with remnants of flesh adhering to it.

Rock: This is one of the favorite resorts of acarids. Some species evidently live on the sound rock, others on the lichens or decaying organic matter on the rock and still others take refuge in the crevices of rock. Many species were obtained from this source.

Decaying leaves, humus, soil from roots of plants, etc.: Decaying leaves is especially a very favourable resort for acarids, Some live on the decaying matter and others hibernate under the leaves.

Bulbs and Tubers: Here again nearly every kind of bulb and tuber tested yielded one or more species of mite, e.g., Potatoes, Calla Lillies, Hyacinths, Onions, etc.

Fruits: Only a few fruits were tried. The apple is the only one that responded. The mites on the apples were feeding on the wax covering the surface. The King gave the best results.

Roots and Vegetables, etc.: From beets, mangolds, turnips, artichokes, Kohl Rabi, parsnips, squash, mites were obtained.

In root houses and such places the mites carry spores of moulds on their feet and disseminate the fungus.

Moss: A few species were obtained from moss.

Nests: The nests of robins, mice, domestic fowl, were the only ones tried and from each one or more species were obtained.

Vertebrate Animals: Several animals were killed and placed on the sieve and mites were obtained from the following: young mice, mature mice, robins, groundhogs, and muskrats.

Fungi: Only a few specimens were tried. Polyporus and Boletus were infested.

Boards and Sawdust: In this case the mites were probably hiding or hibernating.

Grains: Some of the different kinds of grains that mites were obtained from were: Wheat, barley, corn, oats, mangold seed; whole and ground oats.

Decaying material: Decaying squash, parsnips, potatoes, apples, beets, Kohl Rabi and carrots all yielded mites.

Hay: From Timothy and Clover hay mites were taken.

Cones: One or two species were obtained from Pine cones.

Miscellaneous: Litter from chicken run, grass, road scrapings, living Chickweed, flowers of plants, roots of herbs, granary sweepings, decaying stumps, artichoke stubble, etc.

The aquatic apparatus is made of the same material as the terrestrial one—tin and copper. It works on the same principle as the terrestrial machine, that is when an arthropod becomes uncomfortable it goes up or down to obtain air. The Hexapods usually go up or to the surface of the water and the Arachnids go down, but instead of applying heat a few drops of formalin or alcohol is added to the aquatic material. The trap consists of a central bowl with a metallic sieve above and below. The material to be examined is placed in the bowl and enough water is added to fill the bowl to the level. When the alcohol or formalin is added the aquatic larvae go up to the top of the cone and are pulled out by a little strainer. The Acarids, etc., go down and are caught in a bottle below.

This collecting trap may be taken to a pond or lake and in a short time an immense amount of material can be obtained.

A CATALOGUE OF THE GALL INSECTS OF ONTARIO.

By Tennyson D. Jarvis, O. A. C., Guelph.

The insects which produce galls are confined to the following orders: Acarina, which are not true insects, but mites; the Diptera or flies; the Hemiptera, or bugs; the Lepidoptera, or moths and butterflies; the Coleoptera, or beetles; and the Hymenoptera, or bees, wasps, ants and sawflies.

Their food-plants cover a wide range, some twenty-six orders of plants being affected by them. Some species show a decided preference for certain groups of plants as the following table will show.

—	Acarina.	Diptera.	Hymenoptera.	Hemiptera.	Lepidoptera.	Coleoptera.
Rosaceae	13	14	17	3		1
Cupuliferae	13	5	22			
Salicaceae	13	10	5	3	1	1
Urticaceae	5	7		6		
Compositae		10	3	1	3	
Juglandaceae	2	7		6		
Sapindaceae	7	3				
Vitaceae	2	5				
Tiliaceae	3	2		1		
Oleaceae	5	2				
Anacardiaceae	2			1		
Cornaceae		3				
Coniferae		1		1		1
Geraniaceae		2				
Gramineae		2				
Hamamelideae				2		
Labiateae		3			1	
Araliaceae		1				
Ericaceae			1			
Iridaceae		1				
Leguminosae					1	
Magnoliaceae		1				
Rhammaceae					1	
Rubiaceae	1					
Saxifragaceae				1		
Verbenaceae			1			
Total	61	77	49	24	7	3

Acarina.

Family—Eriophyidæ. Gall Mites.

This is a family of microscopic mites which are quite curious and unusual in structure. They have only two pairs of legs and the abdomen is long and striated. These striations, which differ in the different species, and differ in number on the dorsal and ventral surfaces are of considerable value in classification. The galls produced vary in form, but are always open or provided with an opening through which the mites pass in and out. They are generally lined with minute hairs (trichomes) which may be simple or branched. The different types of phytoptid galls are shown below, figures 20 to 28.

FIG. 20. Erineum on leaf of beech; natural size and highly magnified.

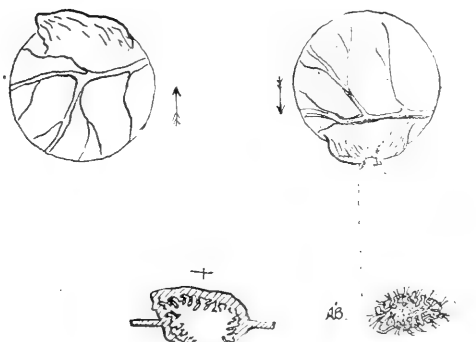


FIG. 21. Capsule Gall: Upper and lower surfaces; interior and opening of capsule, highly magnified.

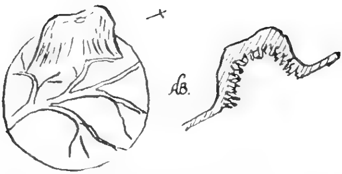


Fig. 22. Dimple Gall and section of interior greatly magnified.

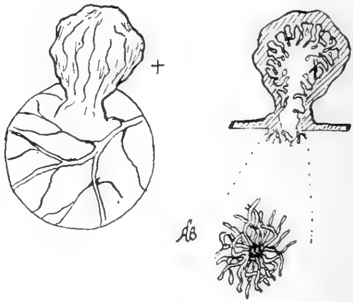


Fig. 23 Pocket Gall : Upper surface of leaf ; interior of gall, much magnified.

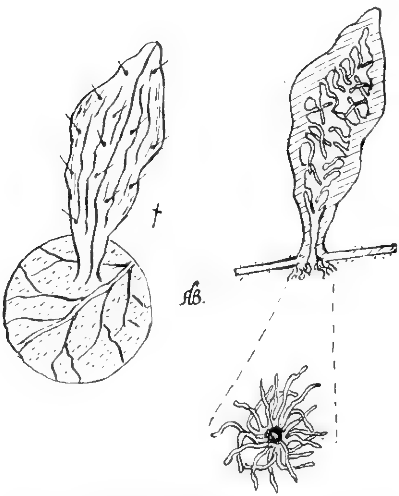


Fig. 24. Pouch Gall on upper surface of leaf ; interior of gall, much magnified.

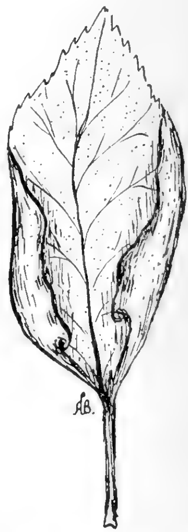


Fig. 25. Leaf-margin Gall.

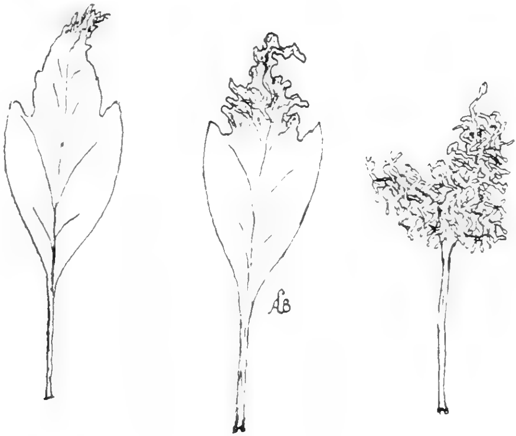


FIG. 26. Leaf-distortion Gall, different stages.

FIG. 27. Bud-like Galls.

FIG 28. Serpentine Gall.

A simple apparatus, based upon the principle that most insects seek light, provides an efficient and safe method of obtaining parasites from parasitized material, rearing gall insects, etc. Figures 29 and 30.

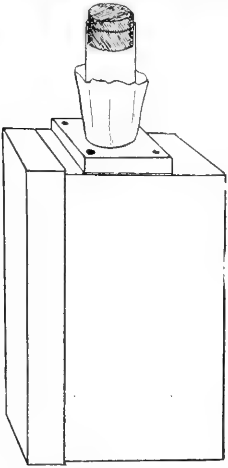


FIG. 29. Apparatus for procuring Parasites. (Side view.)

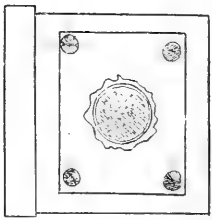


FIG. 30. Apparatus for procuring Parasites. (View from above.)

It consists of a simple cardboard box about 20 x 12 x 12 cm., upon one end of which is fixed by tacks driven through the cardboard from inside, an oblong block of wood about 9 x 7 x 1 cm. with a hole about 2.5 cm. in diameter bored through the centre of it. The cardboard behind this hole is removed neatly leaving a circular hole opening into one end of the box. Into this hole the paper cone, open at both ends, is thrust. A glass tube is thrust into the paper cone. This provides an arrangement which is quite tight and yet easy to handle. The material from which it is desired to obtain insects or parasites is placed in the box. When the insects emerge into the tube it is removed quickly and corked and another tube is put in its place. In case work is being done with very small insects a sheet of cotton cloth covered with a thin layer of cotton batting may be placed over the top of the box and the lid forced down over it, thus preventing the escape of any under the lid. When all the insects which are living have emerged, the material remaining in the boxes may be examined for dead insects.

COLEOPTERA.

Family-Buprestidæ. Metallic Wood Borers.

A few produce galls, the most important one being the Red-necked Agrilus, producing galls on the Raspberry and Blackberry.

Family-Cerambycidæ. The Long-horned Beetles.

These beetles are of medium or large size. The body is oblong or cylindrical and the antennæ are long, often longer than the body. Only one species of gall maker is known to occur in Ontario; the Willow Branch Borer (*Saperda concolor*).

Family-Curculionidæ. The Curculios or Weevils.

In this family the head is prolonged into a beak which is sometimes longer than the remainder of the body. Specimens of the Red Pine Stem Gall (*Podapion gallicolla*) were received from Mr. A. Cosens, Toronto.

Lepidoptera.

Family-Tortricidæ.

The Tortricids are generally small moths; but as a rule they are larger than the Tineids. *Ecdytolopha insiticiana* is abundant on the Honey Locust and *Eucosma Scudderiana* is common on the Goldenrod.

Family-Tineidæ. The Leaf-miners and Clothes Moths.

The family contains but few gall makers. Species Nepticula occurs on the Aspen and *Stagmatophora ceanothiella* is found at Toronto on New Jersey Tea.

Family-Gelechiidæ.

These are small moths closely related to the Tineids. Two species, belonging to the genus Gnormischema, are abundant on Solidago.

Hemiptera.

Family-Aphididæ. Aphids or Plant Lice.

These are small, soft-bodied insects which suck up the juices of plants and which often produce galls. The galls produced vary in form from mere leaf curls to forms of most curious appearance but of quite simple structure. They are all open or furnished with an opening. Twenty-two species of gall producers are recorded for Ontario.

Family-Psyllidæ. Jumping Plant Lice.

The members of this family resemble the preceding to a great extent, but they are not so numerous. The hind legs are formed for jumping. Only two species are so far recorded for Ontario.

Diptera.

Family-Cecidomyidæ. Gall Gnats.

These are very delicate, small, two-winged flies with few veins in the wings and with sucking mouth parts. The eggs are laid upon the leaf surface and the larva either feeds there, making an open gall, or makes an incision in the leaf and enters, forming a closed gall, which splits open at maturity at the point where the larva entered. The Larvæ can be readily identified by their color, which is orange, red or pink, and by the development, between the second and third segments of the body, of a peculiar, horny projection called the breast-plate, the use of which is not definitely known. Eleven genera have been recorded for Ontario.

Family-Agromyzidæ.

They are small flies closely related to the Trypetidæ. Only a few are gall makers. One species occurs on Iris and another on Salix.

Family-Trypetidæ.

This family comprises a large number of rather small flies, usually with prettily-marked wings. A few species belonging to the genus Trypeta produce galls on the stems of composites.

Hymenoptera.

Family-Tenthredinidæ.

Of this family the Nematinæ produce galls. The head and thorax are wide. The base of the abdomen is broadly joined to the thorax and the abdomen of the female is furnished with a pair of claws. The larvæ have from twelve to sixteen prolegs. These insects have been very thoroughly taken up by Norton in his monograph on the Nematinæ. A large number make galls on Willow.

Family-Cynipidæ. Gall Flies.

This is a family of very minute, four winged insects. In the adult gall-fly the abdomen is unusually compressed and joined to the thorax by a short peduncle, the first abdominal segment. The ovipositor is long and slender. The insect deposits its eggs within the tissues of the plant by piercing it with its ovipositor. The galls produced are closed and the insect emerges at maturity through a hole it cuts in the gall.

The writer's thanks should be here expressed to those who have so kindly assisted in the preparation of this paper. I am under special obligation to Prof. Bethune, O.A.C., Guelph; Dr. E. Porter Felt, State Entomologist, N.Y.; Mr. A. Cosens, Toronto, and Mr. W. R. Thompson, Guelph, and Mr. C. D. Jarvis, Storrs, Conn.

The present list is arranged alphabetically by host plants.

Affecting Alder.

A white, frost-like erineum on under side of leaf in the axils of the veins. Trichomes dense, pellucid.—*Eriophyes* sp.—Alnus incana.

A small, red or green pubescent pocket gall on leaf. Alder Pocket Gall—*Eriophyes* sp.—Alnus incana.

A rounded gall, a deformation of the terminal bud. Alder Bud Gall.—*Dasyneura serrulatæ*—O.S. Alnus incana.

Affecting Ash.

Spherical, pulpy green galls about the size of a pea, springing from the upper surface of the midribs or veins. Ash Ball Gall—*Cecidomyiadæ*—Fraxinus sambucifolia.

Elongated, green, succulent galls on the under side of the leaf. Ash Midrib Gall—*Cecidomyia pellex*—O.S. Plate F., fig. 5. Fraxinus americana.

Small, irregular, smooth, more or less spherical capsule gall, protruding on both sides of the leaf. Ash Mite Gall—*Eriophyes fraxini*—Garman, Fraxinus americana.

Pinkish white, elongated capsule galls on the veins of the leaf. Ventrally the galls appear as white, hairy projections following the veins. Ash Vein Gall—*Eriophyes* sp.

A deformation of the terminal buds, their development arrested, producing a mass of small twisted leaf ends. *Eriophyes* sp.—Fraxinus americana.

Leaves dwarfed and distorted in a bundle. Resembles somewhat Cecidomyia solidaginis. Ash Bunch Gall—*Eriophyes* sp. Plate L., fig. 2. Fraxinus americana.

Small, irregular, more or less spherical capsule gall protruding on both sides of leaf. Galls hairy—*Eriophyes* sp. Fraxinus pubescens.

Affecting Barley.

A small gall forming a woody growth which fills up the cavity of the stalk and causes the joints to swell. Barley Joint-Worm Gall—*Isosoma hordei* (Harris). Hordeum vulgare.

Affecting Basswood.

A.—*Galls on the leaves.*

Balloon-shaped galls on the upper surface of the leaf Apex of gall usually serrated. Basswood Balloon Gall—*Eriophyes abnormis* Garman—Plate I., fig. 6. Tilia americana.

Irregular, circular, dark reddish-brown spots about 4-5 mm. in diameter, having in their centre very characteristic tufts of whitish hairs. Basswood Tufted Gall. Tilia americana.

A white erineum or shallow dimple on underside of leaf, much like the Erineum on Acer negundo. *Eriophyes* sp.—Plate M., fig. 4. Tilia europea.

Small swellings about 3 mm. in diameter, protruding from both sides of the leaf. Red above and green below. Basswood Wart Gall—*Cecidomyia verrucicola*, O.S. Tilia americana.

B.—*Galls on Stem.*

Oval swellings of the cortex about 1 cm. long. Texture pith-like, surface smooth and of the same color and appearance as the bark. Basswood Egg Gall. Tilia americana.

Affecting Bearberry.

Red galls about 10 mm. long and 4. mm. broad, upon the leaves. Resulting from the folding over of the edge of the leaf or sometimes both edges, forming a pocket. Bearberry Leaf Gall—*Pemphigus Coweni* (Ckl.)—Arctostaphylos uva-ursi.

Affecting Beech.

A frosty, white erineum in large patches on the under side of the leaf. Trichomes spherically capitate. *Eriophyes* sp.—Plate H., fig. 4. Fagus americana.

Affecting Blue Beech.

Fold of the leaf along the veins forming a long hollow tube. Vein Gall of Blue Beech—*Cecidomyia pudibunda*—O.S. Plate E., fig. 6. Carpinus caroliniana.

Affecting Birch.

A bud deformation, crowded and irregular, often in bunches of large size. Birch Bud Gall—*Eriophyes* sp.—Plate G., fig. 6. Betula lutea.

A rosy pink erineum in large patches on the upper side of the leaf. *Eriophyes* sp.—Betula lenta.

A yellowish-white to brownish erineum forming large patches between the ribs on the under side of the leaf. *Eriophyes* sp.—Betula papyrifera.

A transparently white, granular erineum on the surface of the leaves—*Eriophyes* sp.—Betula pumila.

A capsule gall, very small, yellow to brown. Paper Birch Capsule Gall—*Eriophyes* sp.—Plate M., fig. 5. Betula papyrifera.

A nodular pocket gall, occuring upon both faces of the leaf: yellowish or reddish to purplish. Paper Birch Pocket Gall—*Eriophycs* sp.—Plate K., fig. 1. Betula papyrifera.

Affecting Blue Flag.

An oval enlargement on the inside of the leaf, usually about 1 inch from the tip. Iris Leaf Gall—*Agromyza magnicornis* (Lowe)—Iris versicolor.

Affecting Boneset.

Oval swellings on the stems and leaf stalks. Boneset Stem Gall—*Choristoneura perfoliatum* (Felt)—Plate A., fig. 5. Eupatorium perfoliatum.

Affecting Bramble.

A.—*Galls on leaves.*

Irregular-shaped, woody swellings at the base of the leaflets, or on the midrib of the Blackberry. Wood Leaf Gall—*Lasioptera farinosa* (Wm. Beutm)—Rubus villosus.

Irregular sub-conical stem galls about three-quarters of an inch in length. Blackberry Stem Gall—*Lasioptera nodulosa* (Beutm)—Rubus villosus.

B.—*Galls on stem.*

A mass of hard, small cells covered with a dense thick mass of green filaments clustered around a branch or twig of Blackberry. From 1.5 to 2 cm. in diameter. Mossy Rose Gall—Rhodites rosæ (Linn)—Plate B., fig. 1. Rubus villosus.

Large, oblong, polythalamous stem gall, 1 to 3 inches in length. Surface uneven with deep longitudinal furrows which divide the gall, more or less completely, into 4 or 5 portions. Pithy Blackberry Gall—*Diastrophus nebulosus*, O.S.—Rubus villosus.

Symmetrical swellings of the Blackberry cane. Gouty Gall *Agrilus ruficollis* (Fab.)—Rubus villosus.

Hard woody, somewhat globular, seed-like bodies 2 to 4 mm. in diameter formed in clusters on the stem. More or less covered with curved spines which are about 2 mm. long. Blackberry Seed Gall—*Diastrophus cuscutæformis* (O.S.)—Rubus villosus.

Large, reddish-brown, polythalamous, tubercular or irregular gall about 1 to 1.75 inches long and .5 inches in diameter, arising abruptly on the stem. Green in summer, darkening towards winter. Raspberry Stem Gall—*Diastrophus turgidus* (Bass)—Plate B., fig. 2. Rubus strigosus.

Affecting Bugleweed.

An elliptical or sometimes almost spherical gall formed on the stem. Bugleweed Stem Gall—*Lasioptera lycopi* (Felt)—Plate N., fig. 5. Lycopus virginicus.

Affecting Buttonbush.

Clusters of small dimples on the upper side of the leaf, 1 to 3 mm. high. Buttonbush Dimple Gall—*Eriophyes cephalanthe* (Cook)—Plate K., fig. 5. Cephalanthus occidentalis.

Affecting Chestnut.

A small capsule gall, on the leaf, more or less spherical and 2-3 mm. in diameter. Chestnut Capsule Gall—*Eriophyes* sp.—Castanea sativa, var. americana.

Affecting Cinquefoil.

Oval or spherical galls from ¼ to ½ inch in diameter, arising in the axil of the leaves. Cinquefoil Axil Gall—*Diastrophus potentillæ* (Bass)—Plate B., fig. 5. Potentilla Canadensis.

Oval or cylindrical swellings from 1 to 2 inches long on the stems usually near the base of the plant, Monothalamous. Cinquefoil Stem Gall. Potentilla norvegica.

Affecting Currant.

Red or purple elevations or folds on the upper side of the leaf. Currant Leaf Gall—*Myzus ribis*, Linn—Ribes rubrum.

Affecting Dandelion.

Irregular, knotty, pithy swellings, forming oblong irregular galls along and surrounding the leaf-petiole; average length from one-quarter of an inch to fully two inches. Dandelion Petiole Gall—*Gilletia Taraxaci*, Ashmead—Taraxacum officinale.

Affecting Dogwood.

Club-shaped and about ½ to 1 inch long. On terminal twigs. Dogwood Club Gall—*Cecidomyia clavula* (Beutm.)—Cornus florida.

Thin-walled circular elevations on the under side of the leaves. Dogwood Leaf Gall—*Lasioptera corni* (Felt)—Plate A., fig. 2. Cornus florida.

Small, nearly oval Gall situated on the petiole of the leaf. Flowering Dogwood Petiole Gall. Cornus florida.

Affecting Elm.

A.—*Galls on the leaves.*

Round dimples in the backs of the leaves resulting in small elevations on the upper side. About 2 mm. in diameter and surrounded by an areola of lighter green. In the cavity of the gall rests a small, white larva covered with a viscid, transparent secretion. Pimple Gall—*Cecidomyiadæ*—Plate P., fig. 4. Showing larva and gall.

Ulmus americana.

A leafy growth arising from a bud and resembling the Pine Cone Willow gall but more nearly spherical and only about ½ an inch in diameter. Remains green during summer but changes to a dark brown in winter. Red Elm Bud-Gall—Plate P., fig. 6. Ulmus pubescens.

A green plum-like structure on the upper surface of the leaf. About 10 to 12 mm. in length and 3 to 7 mm. in thickness. Plum Gall—*Pemphigus ulmi fuscus*—Ulmus campestris.

There is a similar gall on Red Elm, but differing in the following respects: (1) It is twice as large. (2) The wall is a little thicker. (3) The

surface is rough like the leaf not glossy. (4) The part of the leaf around the base is quite normal in appearance, showing no signs of being weakened through lack of nourishment. Ulmus pubescens.—Plate C., fig. 8.

Hollow, cock's comb-like, thin walled gall; on the upper surface of the leaf. Cockscomb Gall—*Colopha ulmicola* (Fitch)—Plate I., fig. 5. Ulmus americana.

A pulpy thickening of the tissues on the under surface of the leaf, extending for some distance along the midrib. Causes the upper surface to double on itself instead of expanding in the ordinary way. Leaf Fold Gall—*Cecidomyia ulmi* (Beutm)—Plate A., fig. 1. Ulmus americana.

Curling and gnarling of the leaves forming thereby a sort of pseudo-gall. Woolly Aphid Leaf Gall—*Schizoneura americana* (Riley)—Plate Q., fig. 1. Ulmus racemosa.

B.—*Galls on the stems.*

Aphids clustering on the limbs and trunks, causing a knotty unnatural growth of the wood. Woolly Aphid Stem-gall—*Schizoneura Rileyi* (Thomas). Ulmus americana.

Small green to yellowish pocket-galls, more or less spherical, usually on the upper side of the leaves. Elm Pocket Gall—*Eriophyes ulmi* (Garman)—Plate H., fig. 5 and 6. Ulmus americana and U. Racemosa.

An erineum on the under side of the leaf; white at first changing to brown. Trichomes simple, tangled. Rock Elm Erineum Gall—*Eriophyes* sp.—Plate H., fig. 3. Ulmus racemosa.

A very large pouch-gall on the leaves, commencing as a cone or deep dimple. *Eriophyes* sp.—Plate L., fig. 6. Ulmus pubescens.

A cone-shaped pouch gall resembling those on Tilia and much larger than Eriophyes ulmi. On the upper surface of the leaf, often very many on a single leaf but thickest along the midrib usually; shape irregular but usually tapering towards both ends and twice as long as thick, average length being about 5 mm., and average thickness about 2-2.5 mm.; color green. *Eriophyes* sp.—Plate L., fig. 5. Ulmus americana.

Affecting Evergreens.

Irregularly oblong gall, situated near the base of the needle on the new growth. Balsam Fir Needle-gall—*Cecidomyia balsamicola* (Lintner)—Plate A., fig. 3. Abies balsamea.

Oval swellings on the twigs of various species of Spruce. Spruce Gall louse—*Chermes abietis*—Picea nigra, P. excelsa and P. alba.

The gall consists of an enlargement of the smaller branches. Red Pine Stem Gall—*Podapion gallicolla* (Riley)—Pinus resinosa

Affecting False Nettle.

An elongate, fusiform swelling of the stalk. False Nettle Stem Gall—*Cecidomyia* (?) *bœhmeriæ* (Beutm)—Bœhmeria cylindrica.

Affecting Ginseng.

Spherical or irregularly cylindrical, brown galls upon the roots. Ginseng Root Gall. Aralia nudicaulis.

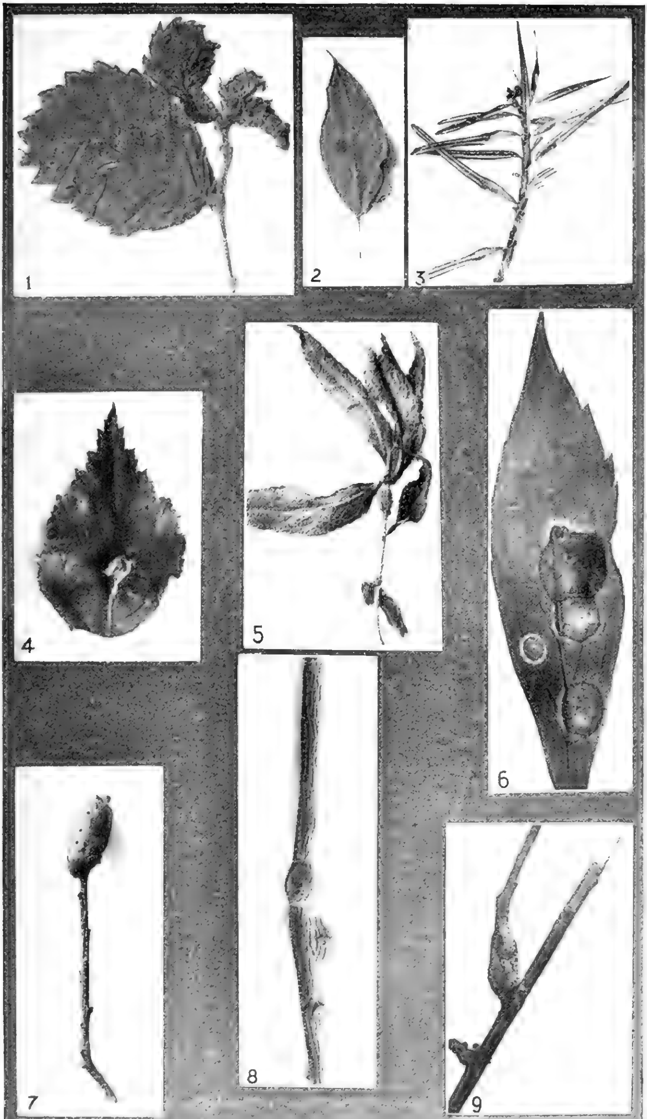


PLATE A.

1. Cecidomyia ulmi Beuten.
2. Lasioptera corni, Felt.
3. Cecidomyia balsamifera, Lintner.
4. Hormomyia cratægifolia, Felt.
5. Choristoneura perfoliata, Felt.
6. Choristoneura flavolunata, Felt.
7. Rhabdophaga batatas, O.S.
8. Agromyza æneiventris, Fallen.
9. Rhabdophaga nodulus, Walsh.

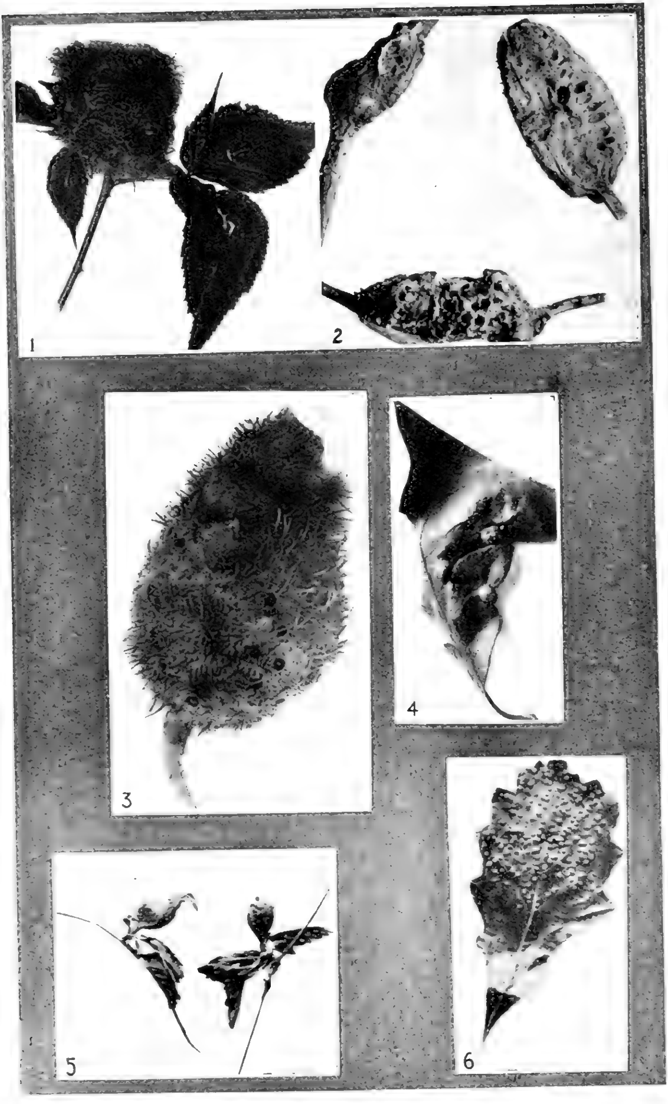


PLATE B.

1. Rhodites rosae, Linn. on Blackberry.
2. Diastrophus turgidus, Bass.
3. Rhodites multispinosus, Gill.
4. Andricus futilis, O.S.
5. Diastrophus potentillæ, Bass.
6. Neuroterus umbilicatus, Bass.

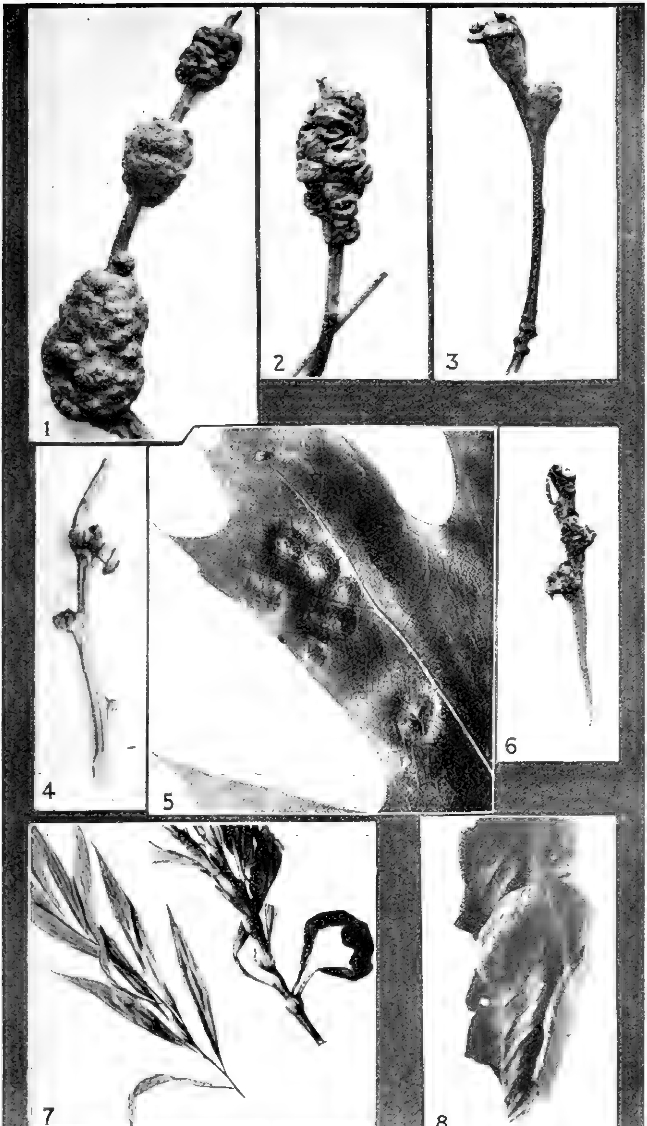


PLATE C.

1. Andricus punctatus, Bass.
2. Biorhiza forticornis, Walsh.
3. Andricus clavula, Bass.
4. Cynips strobilana, O.S.
5. Andricus papillatus, O.S.
6. Andricus topiarius, Ashm.
7. Eucosma scudderiana, Clem.
8. Pemphigus ulmi-fuscus.

PLATE D.

1. Eriophyes sp., Amelanchier Canadensis.
2. Eriophyes sp., Juglans nigra.
3. Eriophyes sp., Populus italica.
4. Eriophyes sp., Vitis cordifolia.
5. Eriophyes sp., Salix fragilis.

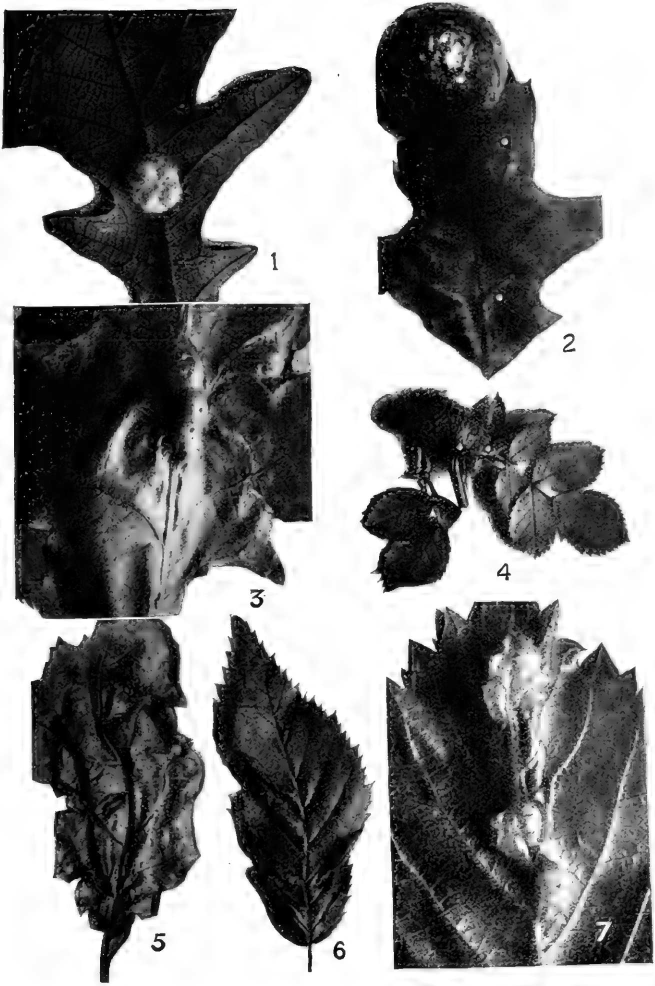


PLATE E.

1. Furry Ball Gall on Oak. (*Andricus lana.*)
2. The Larger Oak-Apple. (*Amphibolips confluentis.*)
3. Oak Midrib Gall. (*Andricus piger.*)
4. Mossy Rose Gall. (*Rhodites rosae.*)
5. Vein Gall on Oak. (*Cecidomyia quercus-majalis.*)
6. Vein Gall on Blue Beech. (*Cecidomyia pudibunda.*)
7. Virginian Creeper Midrib Gall. (*Cecidomyia sp.*)

PLATE F.

1. Ball Gall on Hickory. (*Diplosis caryae.*)
2. Spiny Ball Gall on Wild Rose. (*Rhodites nebulosus.*)
3. Ball Gall on Wood Nettle. (*Cecidomyia urnicola.*)
4. Rose Stem Gall. (*Rhodites globulus.*)
5. Ash Gall. *Cecidomyia pellex.*)
6. Eye Spot Gall of Maple. (*Cecidomyia ocellata.*)

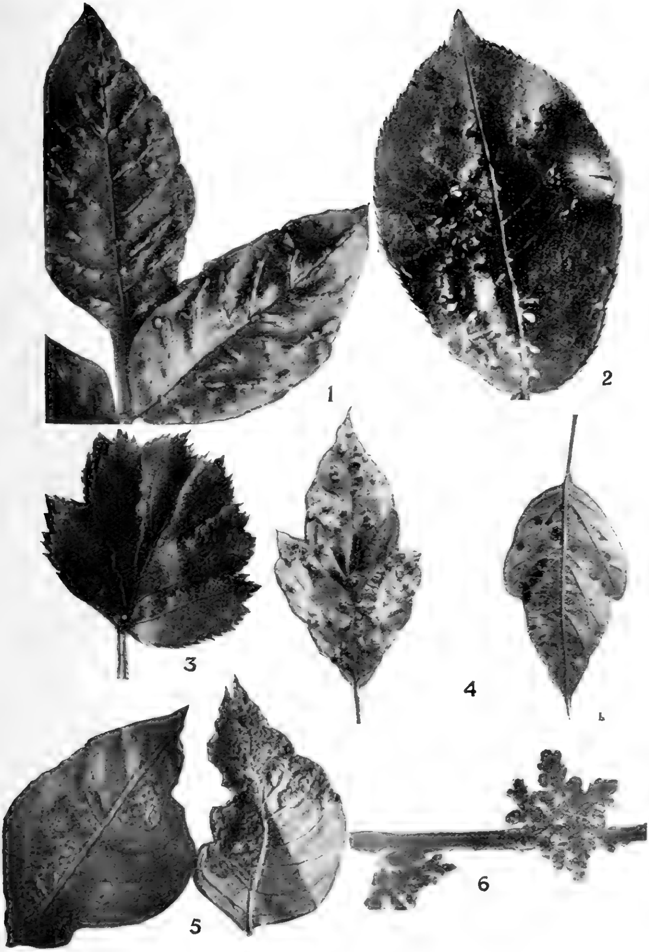


PLATE G.

1. Vein Gall on White Ash. *Eriophyes sp.*
2. Chokecherry Mite Gall. *Eriophyes. sp.*
3. Hawthorn Serpentine Gall. *Eriophyes sp.*
4. Manitoba Maple Wart Gall. *Eriophyes sp.*
5. Poison Ivy Mite Gall. *Eriophyes sp.*
6. Birch Bud-Gall. *Eriophyes sp.*

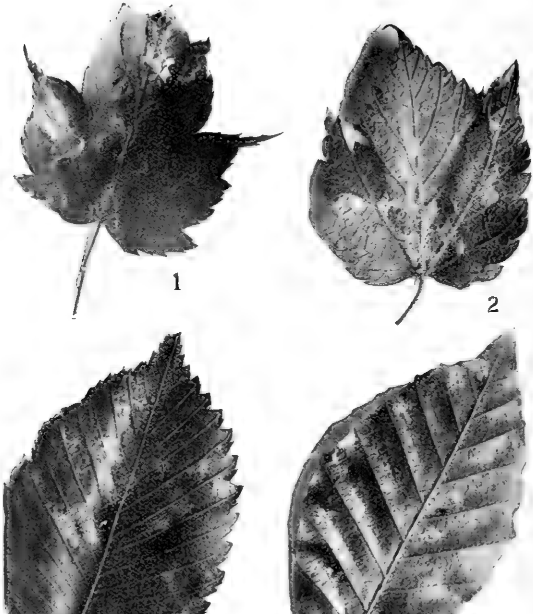


PLATE H.

1. Sugar Maple Pink frost-gall. *Eriophyes sp.*
2. Mountain Maple frost-gall. *Eriophyes sp.*
3. Rock Elm frost-gall. *Eriophyes sp.*
4. Beech frost-gall. *Eriophyes sp.*
5. Elm mite gall. *Eriophyes ulmi.*
6. Elm mite gall. Enlarged opening on under surface.

Affecting Goldenrod.

A.—*Galls on leaves.*

Circular or somewhat irregularly elliptical, spot-like galls, only projecting very slightly from each side of the leaf. The main part of the spot is light colored, this being enclosed by a dark ring giving it some resemblance to an eye. Lunate Marginal Gall—*Choristoneura flavolunata* (Felt)—Plate A., fig. 6. Solidago Canadensis.

Small, oblong, or seed-like galls, light green in color, on the lower surface of the leaves. Seed Gall. Solidago Canadensis.

Conical leafy structure ½ to 1½ inches high and ½ inch in diameter. Between the thickened parts of the leaflets live from one to many, small, orange coloured larvæ. Terminal Gall—*Asphondylia monacha* (O.S.)—Solidago Canadensis.

Leaves thickened and folded lengthwise, somewhat like a pod: green or red in colour. Leaf-fold Gall—*Chaitophorous* sp. (undescribed)—Solidago Canadensis.

B.—*Galls on the stems.*

Large, elongated, monothalamous gall with a very large larval chamber situated on the stem below the branches. Elliptical Gall—*Gnorimoschema, gallœsolidaginis* (Riley).

Spindle-shaped galls about 3 cm. in length. Situated high up on the stem on the main axis of the plant among the branches, often causing some of these to abort. It passes the winter in the larval stage. Goldenrod Spindle Gall—*Eucosma Scudderiana* (Clemens)—Plate J., fig. 2. Solidago Canadensis.

Elliptical, hollow gall, 1.25 inches in length, .48 of an inch in diameter, the diameter of the plug .08 of an inch. The galls are found a short distance above the ground.—Gnormischema gallæisterella (Kell). Solidago Canadensis.

Apical, bunch-like galls produced by the arrest of growth in the stalk, which causes the leaves to accumulate. Bunch Gall—*Cecidomyia solidaginis* (Loew)—Solidago Canadensis.

Globular, ball-like enlargement about 1 inch in diameter. Ball Gall—*Trypeta solidaginis* (Fitch)—Plate J., fig. 3. Solidago Canadensis.

Consists of small bunch of accumulated aborted leaves about ½ inch in length. Cylindrical Bunch Gall—*Trypeta polita* (Loew)—Solidago Canadensis.

C.—*Galls in flower stalk.*

Bud-shaped, green galls, which are larger and stouter than the normal buds. Bud Gall—*Cecidomyia racemicola* (O.S.)—Solidago Canadensis.

Affecting Gooseberry.

An irregular or rounded cluster of bud-like galls arising from a spherical receptacle on the stem. Gooseberry Bud Gall. Plate O., fig. 6. *Ribes cynosbati.*

Affecting Grape.

A.—*Galls on leaves.*

A white erineum on the underside of the leaf. Trichomes simple. *Eriophyes sp.*—Plate L., fig. 4. Wild Grape.

Small, semi-circular or nearly circular capsules along the veins, about 2 mm. in diameter and but slightly elevated on either surface of the leaf. On

upper surface paler than the leaf, below, with a white nipple surrounded by a furrow. *Eriophyes* sp.—Vitis cordifolia.

Small, rough galls usually on the upper surface of the leaf. The galls are very numerous, and frequently the leaves are absolutely covered with them. Grape phylloxera—*Phylloxera vastatrix* (Planchon)—Vitis sp.

Elongated, conical, red galls, .7-1 cm. in length usually on the upper side of the leaves. Grape Vine Tube Gall—*Cecidomyia viticola* (O.S.)—Plate O., fig. 1. Vitis sp.

Irregular, soft and succulent swellings on stems and leaf-stalks of Grapes; yellow green or red in color. Grape-vine Tomato Gall—*Lasioptera vitis* (O.S.)—Vitis sp.

Oval, red swellings of the petiole. About ½ inch long and ¼ of an inch in diameter. Grape Petiole Gall—Vitis cordifolia.

B.—*Galls on Stems.*

Rounded galls flattened at the base and jointed at the top. On the stems of Wild Grapes. Grape-vine Apple Gall—*Cecidomyia vitis-pomum* (Walsh & Riley).

Affecting Hackberry.

A witch-broom gall on branches and twigs. Hackberry Witch-broom Gall—*Eriophyes* sp.—Celtis occidentalis.

A woody gall with bluntly-rounded apex and slightly constricted at the point of attachment to the leaf. Opposite the gall is a concave depression. Hackberry Nipple Gall—*Pachypsylla celtidis-mammæ* (Riley)—Celtis occidentalis.

Circular spot-like gall on the under side of the leaf with a small nipple in the middle. Hackberry Blister Gall—*Pachypsylla celtidis-vesiculum* (Riley)—Celtis occidentalis.

Affecting Hawthorn.

A fold of the leaf making long, irregular, wavy projections on the upper surface of the leaf. From the midrib to the edge of the leaf is the general direction of the gall. Serpentine Gall—*Acarus cratægi vermiculus*—Plate G., fig. 3. Cratægus sp.

Small, round swellings (capsules) protruding very slightly on both sides of the leaf. About .5-1 mm. in diameter. Galls very numerous where they occur—sometimes more than 100 on a single leaf. Speck Gall—*Eriophyes* sp.—Cratægus sp.

These tiny oval galls can be easily recognized from their peculiar habit of arranging themselves all around the margins of the leaf, thus forming a sort of border for it. They are often so numerous that there is one for each serration. Each gall is about 2 mm. long, 1 mm. wide, and about 5 mm. thick. It extends about equally beyond both surfaces of the leaf and is of much the same texture as the leaf itself, except that towards the apex both it and the apex of the serration on which it is situated tend to become brown. In this brown part there is a small aperture. The gall is monothalamous, and contains a single, yellowish white, short, fat larva, which on July 31st had not yet begun to pupate. Hawthorn Leaf-border Gall—Plate N., fig. 7. Cratægus sp.

Small red, pod-shaped structures slightly tapering towards one end on the upper surface of the leaf. From 5-8 mm. long and about 2 mm. wide. Pod Gall—*Cecidomyidæ*—Cratægus sp.

Tiny, oval structures arranged around the margin of the leaf. Often so numerous that there is one for each serration. Leaf-border-Gall *Cecidomyia* Cratægus sp.

Green or pink, globular, bladder-like structures on the under surface of the leaf. About 5 mm. in diameter. Bladder Gall—*Cecidomyidæ*—Plate O., fig. 5. Cratægus sp.

Very small, monothalamous, conical structures, 1 to 2 mm. high and 1,1.5 mm. wide at the base; formed anywhere on either surface of the leaf and sometimes on the stem of young twigs. Cone Gall —*Eriophyes*—Cratægus sp.

Cylindrical structures, hollow, red or green in color, about 3 mm. in height and diameter and with a hole in the top. Top of gall thickly set with spines. Burr Gall—*Cecidomyia bedeguar*, O.S.—Plate O., fig. 3. Cratægus sp.

Cock's comb-like structure on the upper surface of the leaf. Cock's Comb Hawthorn Gall—*Hormomyia cratægifolia* (Felt)—Plate A., fig. 4. Cratægus sp.

Leaf slightly thickened, purplish in color and rolled in upon itself, the under surface being the one enclosed. Wooly Aphid Gall (*Schizoneura*)—Cratægus sp.

Affecting Helianthus.

Globular gall about ½ an inch in diameter on the leaves. Helianthus Ball Gall—*Cecidomyia bulla* (Walsh)—Helianthus divaricatus and H. Strimosus.

Linear-shaped galls in clusters on the stem. *Cecidomyia helianthi* (Brodie)—Helianthus divaricatus and H. strimosus.

Affecting Hazel.

This gall is found only along the main veins of the leaf. The part of the leaf round the affected portion of the vein become crimped, the crimps all radiating towards the vein as a common centre. Hazel Leaf Crimp Gall (Undescribed)—Corylus americana.

A bud deformation, which attacks bud as soon as it expands, and checks its subsequent development. Hazelnut Bud Gall—*Eriophyes avellanæ*—Corylus americana.

Affecting Hickory

A.—*Galls on leaves.*

Flattened, circular, yellow or whitish galls, an inch in diameter. Hickory Button Gall—*Phylloxera fovela*—Plate N., fig.1. Carya glabra.

Red, elongated galls, consisting of a fold of the main veins running from the midrib to the edge of the leaf. Hickory Vein Gall—*Phylloxera caryævenæ*—Carya Glabra.

Cone-shaped gall about 3 mm. in diameter, on the upper side of the leaf. Green in color; the opening on the lower surface is fringed with hairs. Hickory Cone Aphid-Gall—*Phylloxera caryæfallax*—Plate I., fig. 4. Carya ovata.

Hemispherical gall on the upper surface of the leaf, opening on the under surface by means of a narrow slit, ⅛ to ¼ of an inch in diameter. Hickory Hemispherical Gall Phylloxera caryæ-globuli—*Dactylosyhæra hemispæricum*—Carya alba.

Expansion of the young fruit or ovary to two or three times the size of the normal fruit. The centre of the gall is filled with Aphids. Fruit Gall—*Phylloxera* (undescribed)—Carya ovata.

Conical or sometimes almost spherical, red or purplish gall on the under surface of the leaf along the veins. Hickory Cone Gall—*Cecidomyia sanguinolenta* (O.S.)—Carya ovata.

Smooth and rounded, with a fine elongated tip, 5 to 6 mm. in height and 2 to 3 mm. in greatest diameter. Pale green, turning brown in autumn on the under surface of the leaves. Hickory Seed Gall—*Cecidomyia caryæcola* (O.S.)—Carya ovata.

Sub-globular, pubescent, onion-shaped gall on the under side of the leaves. The pubescence is pale when gall is young and rose-coloured when mature. Hickory Onion Gall—*Cecidomyia holotricha* (O.S.)—Plate R., fig. 6. Hicoria ovata.

Narrow, cylindrical, tube-like gall, on the under side of the leaves. Green when immature becoming brown or blackish when ripe. Hickory Tube Gall—*Cecidomyia tubicola*—Carya alba.

Rounded, brownish, downy gall on the under side of the leaves. Resembles somewhat a diminutive peach. About ⅕ to 1/5 of an inch in diameter. Hickory Peach Gall—*Cecidomyia persicoides*—Carya ovata.

Large, irregular knobs all over the husk of the nut containing thick-walled cells. Hickory Nut Gall—*Cecidomyia caryænucicola*—Carya alba.

Thin-walled galls about 3 mm. in diameter, hard and brittle, attached to the under side of the leaves by a projection at the base which appears on the upper side as a black dot surrounded by a light yellow areola. Hickory Ball Gall—*Doplosis caryæ*—Plate F., fig.1. Carya ovata.

B.—*Galls on Stems.*

Large, globular or hickory-nut shaped galls on the stem, petiole or midrib of the leaf. Variable in size. Hickory Aphid Gall—*Phylloxera caryæcaulis* (Fitch)—Carya ovata.

Affecting Horse-Balm.

An inverted, pear-shaped gall much resembling the gall in the Wood Nettle. The large end is weakly attached to a vein on the underside of the leaf. Horse-balm Leaf Gall—*Cecidomyia collinsoniæ* (Beutm)—Plate O., fig. 4.

Affecting Huckleberry.

Rounded or elongated galls 1-2 cm. in diameter on the stem of the Huckleberry. Huckleberry Gall—*Solenogopheria vacinii* (Ashm)—Gaylussacia resinosa.

Affecting Genus Juglans.

The Walnut and Butternut.

A brown, velvety erineum surrounding the leaf stalks, or on the main veins, causing a swelling or bending of the stalk or vein. Walnut Cushion Gall—*Eriophyes* sp.—Plate D., fig. 2. Juglans nigra and probably J. cinerea.

A green pocket-gall on the upper side (usually) of the leaf. Walnut "Wart" Gall—*Eriophyes* sp.—Juglans nigra and probably J. cinerea.

Affecting Juneberry.

Small nearly globular, dark brown, pocket galls, averaging 2 mm. in diameter, singly or in clusters on the upper side of the leaf. Juneberry Ball Gall—*Eriophyes* sp.—Plate D., fig. 1. Amelanchier rotundifolia.

Affecting Locust.

Oval swellings on the branches and twigs, generally occurring at the junction of the leaf petiole with the branch. Locust Twig Borer—*Ecdytolopha insiticiana*—Gleditschia triacanthos.

Affecting Maple.

A whitish frost-like erineum with scattered spots of rosy pink, on the upper surface of the leaf, sometimes nearly covering it. *Eriophyes* sp.—Plate H., fig. 1. Acer rubrum.

A pale yellow or white erineum on the under side of the leaf. Trichomes capitate. *Eriophyes* sp.—Acer saccharinum.

A nearly spherical pocket gall on the upper surface of the leaf, varying from light green through red or purple to black. *Phlœcoptes quadripes*—Plate J., fig. 1. Acer saccharinum.

A white or whitish erineum in patches on the under side of the leaf, often limited by the veins. Trichomes capitate. When old the trichomes assume a brown color. *Eriophyes* sp.—Acer saccharum.

A green, reddish or purplish, slender, pouch-gall projecting from the upper surface of the leaf. *Phlœcoptes aceris*—Plate M., fig. 6. Acer saccharum.

A white or whitish erineum in patches on the under side of the leaf. *Eriophyes* sp.—Acer nigrum.

Irregular wart-like swellings (Dimple) on the upper surface of the leaf. The swellings are green at first and turn gray when mature. The average diameter is about 3 mm. Manitoba Maple Wart Gall—*Eriophyes* sp.—Plate G., fig. 4. Acer negundo.

A white, whitish, or pale yellow erineum on the under side of the leaf, in patches often in the axils of the veins. Trichomes long, tangled and distorted.—*Eriophyes* sp.—Plate H., fig. 2, Acer spicatum.

Target-like, circular, flat galls on the leaves of Red Maple, Eye-spot Gall of Maple—*Cecidomyia ocellata*, O.S.—Plate F. fig. 6. Acer sp.

Swellings on the midrib of the leaflets much resembling the Ash Midrib Gall, Manitoba Maple Midrib Gall—*Cecidomyia negundinis* (Gillette.) Acer negundo.

Irregularly elliptical swellings along the veins of the leaves of Hard Maple, red, green or yellow in colour. Hard Maple Leaf-vein Gall—*Cecidomyid* sp.—Plate P. fig. 1. Acer saccharum.

Affecting Muhlenbergia.

Bud galls with very much enlarged glumes. Muhlenbergia Bud Gall—Lasioptera muhlenbergiæ (Naster) Muhlenbergia glomerata.

Affecting New Jersey Tea.

A terminal, spindle-shaped enlargement of the stem, 10-15 mm. long. New Jersey Tea Stem Gall—*Stagmatophora ceanothiella* (Cosens)—Ceanothus americanus.

Affecting Oak.

An irregular dimple upon the blade of the leaf. From beneath it appears as an irregular concavity, lined with a tangled mass of white vegetable hairs. Oak Dimple Gall—*Euriophyes querci*—Plate L. fig. 3. Quercus macrocarpa.

A dense mat of brown hairs growing in large patches upon the under sides of the leaves. Oak Hair Gall—*Eriophyes* sp.—(Undescribed)—Quercus sp.

A dense, white pubescence upon the under side of the leaves causing a distortion and folding of leaf blade. The pubescence is inside the fold, forming the lining of the gall. Oak Fold Gall—*Cecidomyia Niveipila*, O.S. Quercus rubra.

Green or brown, narrowly oval, inflated galls produced along the veins on the under side of the leaves. The surface of the gall is netted with veins. Oak Vein Gall—*Cecidomyia quercus majalis* O.S.—Plate E., fig. 5. Quercus rubra.

Pale red, saucer-shaped galls in clusters on the under surface of the leaf. Oak Spangles—*Cecidomyia poculum* O.S. Quercus alba.

Small, bright red galls, joined to the leaf by a small portion of the surface, so that they are easily detached without injuring the leaf. The surface of the gall is netted with innumerable fissures between which are small elevations with very short spines. When on the under side of the leaf, the gall is white in color. Oak—*Acraspis macrocarpa*—Quercus macrocarpa.

White, furry, hemispherical mass varying from 4-11 mm. in diameter. This is composed of innumerable fine, woody fibres to which are attached small, round kernels. The Larger Furry Ball Gall—*Andricus lana*—Plate E., fig. 1. Quercus macrocarpa.

Small, button-like enlargements upon the upper and lower surfaces of the leaves. Button Gall—*Neuroterus umbilicatus* (Bass)—Plate B., fig. 6. Quercus macrocarpa.

Small, dithalamous, pea-shaped gall on the upper side of the leaf. The surface is fissured or netted with depressions between which are elevations. Oak Pea Gall—*Cynips Pisum*—Quercus alba and macrocarpa.

Hard, woody gall occurring on midrib or petiole. Green or red in color and more or less roughened on the surface. Oak Petiole Gall—*Andricus petiolicola*.

Large globular gall about 4 cm. in diameter. Exterior surface smooth and somewhat irregular. Interior filled with a spongy mass of fibres, very loosely attached to the wall of the chamber. The Larger Oak Apple Gall—*Amphibolips confluentis*, (Harr.)—Plate E., fig. 2.

Small. pale-green, wart-like gall situated in the parenchyma of the leaf and protruding beyond both surfaces but chiefly beyond the lower. Inside are two or three seed-like, oblong kernels, kept in position by white filaments. Oak Wart Gall—*Andricus futilis*, O.S.—Plate B. fig. 4. Quercus macrocarpa.

Round or oval galls growing on the midrib of the leaf. The gall is white or yellowish and covered with fine bright pink or red spines about 1-2 mm. in length. Oak Hedgehog Gall—*Acraspis erinacei*—Plate R. fig. 1. Quercus alba.

Small spherical gall about 3 mm. in diameter upon the veins of the leaves upon the under side of the leaf. It is thickly covered with fine short hair which forms a cushion all around it. Oak Furry Ball Gall—*Neuroterus floccosus*—Plate R. fig. 2. Quercus alba.

Large, smooth, spherical galls from 2-3 cm. in diameter occurring on the under side of the leaves. The small, spherical, larval cell within the cavity is held in position by a comparatively small number of filaments which radiate from it to the surrounding walls. Empty Oak Apple Gall—*Amphibolips inanis* (O.S.). Quercus rubra.

Somewhat circular, about 4 mm. in diameter, projecting on both sides of the leaf. Above dark red, below yellowish, about three times the thickness of the leaf. Oak—*Andicus papillatus* O.S.—Plate C. fig. 5. Quercus rubra.

Irregular woody swellings of the midrib about 7-8 inch in length, surface is glabrous or slightly pubescent and projects on both sides of the leaf. Oak Midrib Gall—*Andricus pige*—Plate E. fig. 3.

Globular, hollow gall, nearly always at the outer edge of the leaf blade. From .9-1 cm. in diameter and comparatively thin walled. Oak Apple Gall —*Andricus singularis* (Bass.) Quercus rubra.

Cluster of dense, narrow leaflets, springing from a bud. Oak Leafy-wreath Gall—*Andricus topiarius* (Ashm).—Plate C. fig. 6. Quercus macrocarpa.

B.—*Galls on stem.*

Spherical gall, hard and woody with a small cavity in the centre. A short joint at the apex distinguishes this species from Globulus. Pointed Bullet Gall—*Holcaspis duricaria* (Bass.) Quercus macrocarpa.

Hard, conical galls occurring in numbers on the stems. Oak Cone Gall—*Andricus ventricosus* (Bass.)—Plate R. fig. 3. Quercus sp.

Small, soft, bladder-like, one-celled structures, each about 1-3 of an inch in diameter. Arranged in a cylindrical cluster along the stem of the branches. Oak Fig Gall—*Biorhiza forticornis* (Walsh)—Plate C. fig. 2. Quercus alba.

Rosette or head of hard, brown, nut-like, wedge-shaped structures fitting closely to one another and attached at the base to a small, spherical receptacle about ¼-1-3 of an inch in diameter. Pine-cone Oak Gall—*Cynips strobilana* (O.S.)—Plate C. fig. 4. Quercus macrocarpa.

Irregularly oval, woody gall encircling the stem. Polythalamous, containing many cream-colored cases attached to the twig, each case looking very much like an oat seed. Oak Seed Gall—*Andricus seminator* (Harr.)—Quercus alba.

Rough, hard, woody, somewhat globular, knot-like gall, encircling the stem and varying greatly in size, but commonly 1-2 inches in diameter. Oak Knot Gall—*Andricus Punctatus* (Bass.)—Plate C. fig. 1. Quercus coccinea.

Bullet-like, corky gall with a small cavity in the centre. On stem of Burr Oak and White Oak. Oak Bullet Gall—*Holcaspis globulus* (Fitch). Quercus macrocarpa and Q. alba.

Club-shaped, hard and woody with often a few leaves growing from it. ½ to 1 inch in length. Club Gall—*Andricus clavula* (Bass.)—Plate C. fig. 3.

Affecting Poplar.

A. Galls on the leaves.

Small, circular, pimple-like elevations on the upper surface of the leaf, with a corresponding depression on the lower surface. Pimple Gall. (Plate P. fig. 3.)—Populus balsamifera.

Leaf folded at its edge to form a red or green pouch over the gall which is narrow and tent-shaped, and is formed from the leaf surface. Aspen Tent Gall—Plate P. fig. 2. Populus tremuloides.

Oblong enlargements of the petiole close to the base of the leaf. *Nepticula* sp.—Populus tremuloides.

Pear-shaped, monothalamous galls growing on the upper side of the leaf and joined to the leaf by a slight constriction. Aspen Ball Gall—Plate P. fig. 5.—Populus tremuloides.

Large, irregular galls on the tips of the twigs, consisting of a double row of lamina; between these two layers are large numbers of aphids. Vagabond Gall—*Pemphigus vagabundus*—Populus deltoides.

Irregular, spherical gall developed at the junction of the petiole and blade of leaf. Poplar Petiole Gall—*Pemphigus populicaulis*—Plate I. fig. 3. Populus deltoides.

Circular, flat or slightly convex, frost-like patches varying from 2-3 mm. in diameter; on the upper side of the leaf. Large-toothed Aspen Frost Gall—*Eriophyes* sp.—Populus grandidentata.

Circular depressions dimple always on the lower side of the leaf. On the upper side it appears as a green red circular elevation. Large-toothed Aspen Convex Gall—*Eriophyes* sp.—Plate M. fig. 1 & 2. Populus grandidentata.

Dimple-like galls on the upper side of the leaf of the Aspen. Aspen Dimple Gall—*Eriophyses* sp.—Plate M. fig. 3. Populus tremuloides.

Irregular, warty protuberances on the midrib or other veins of the leaf and extending beyond both surfaces but chiefly the upper one. Large-toothed Aspen Vein Gall. Populus grandidentata.

Irregular tubercular masses of closely-packed small reddish-green protuberances on the stem. Unsightly Poplar Gall—*Eriophyes* sp. Populus tremuloides.

A depression on the lower surface of the leaf, 4-12 mm. in diameter and 2-5 mm. in depth. Under surface of gall is orange yellow—*Eriophyes* sp. —Plate D., fig. 3. Populus italica. ...

Margin of leaf distorted and curled. *Eriophyes* sp.—Plate T., fig. 1. Populus tremuloides.

B.—*Galls on the stem.*

Irregular swellings caused by a species of Woolly Aphis, on the smaller branches and twigs of the Cottonwood. Woolly Aphid Stem Gall—*Schizoneura* sp. Populus deltoides.

Irregularly oval, about 1-3 to ½ inch long, smooth and about the same color as the bark. Usually on one side of a branch but sometimes nearly encircling it. Aspen Egg Gall—*Agronyzaaoneiventris* (Fallen).—Plate A., fig. 8. Populus tremuloides.

Affecting Genus Prunus.

Reddish, slender pouch-galls, somewhat irregular and pubescent, 3-4 mm. long and .5-1 mm. in diameter. Pin Cherry Pouch Gall—*Eriophyes* sp. Prunus pennsylvanica.

Green or rosy-red pouch gal on the upper side of the leaf, .5-6 cm. in length. The gall is constricted about half way to the leaf. Black Cherry Pouch Gall—*Eriophyes* sp. Prunus serrotina.

Green or reddish pouch gall on the upper side of the leaf, differing from the Black Cherry Pouch Gall in that the aperture is not funnel-shaped. Choke Cherry Pouch Gall—*Eriophyes* sp.—Plate G., fig. 2. Prunus virginiana.

A very long, slender pouch-gall, green or whitish on either side of the leaf. Wild Plum Pouch Gall—*Eriophyes* sp.—Plate K., fig. 2. Prunus americana.

A tubercular growth, encircling base of buds and shoots. Plum Bud Gall—*Eriophyes phloeocoptes*. Prunus domestica.

A club-shaped, monothalamous gall with one or two leaves growing from its side. The gall is an enlargement of the terminal buds of young

shoots. Black Cherry Bud Gall—*Cecidomyia serotinae*. Prunus Serotina.

A malformation of the fruit. The pit or stone is absent and the fruit is enlarged, forming a thick walled pouch about 1 cm. in length by 5 mm. in width. Chokecherry Pocket Gall—*Cecidomyia virginiana*. Prunus virginiana.

Affecting Genus Pyrus.

Apple, Crab Apple, Pear and Chokeberry.

Dimple galls, with the concavity on the upper surface of the leaf. Internal surface corrugated. Apple Dimple Gall—*Eriophyes* sp. Pyrus malus.

Capsule Galls on the upper side of the leaf. Apple and Pear "Leaf-blister" Gall—*Eriophyes pyri*—Plate K., fig. 6. Pyrus malus, P. coronaria and P. communis.

Knot-like swellings on the stems. Woolly Aphis Gall—*Schizoneura langigeria*. Pyrus malus.

Capsule Galls, very small. When mature, brown in color. Chokeberry Speck Gall—*Eriophyes* sp. Pyrus arbutefolia.

Affecting Rose.

A.—*Galls on the leaves.*

Small, thin walled, spherical galls, red or green in colour, and covered with short spines. About .75 cm. in diameter and monothalamous. Spiny Ball Gall—*Rhodites nebulosus*.—Plate F., fig. 2. Rosa Carolina.

Small, circular galls about 3 mm. in diameter on the upper surface of the leaf. Pale green in colour and characterized by the presence of a little nipple in the centre of the gall. Nipple Gall—*Rhodites lenticularis* (Bass.) Rosa Carolina.

Round, woody, globular or irregularly shaped galls, covered with a white mealy substance. Mealy Rose Gall—*Rhodites ignotus* (O.S.)—Rosa sp.

B.—*Galls on the stem.*

Smooth, corky enlargement rising at each end abruptly from the branch; 2-2.5 cm. in length and 1-1.5 cm. in width. Globular Rose Gall—*Rhodites globulus*.—Plate F., fig. 4. Rosa Carolina.

Hard, small cells, clustered around a branch or twig. The cells are covered with a dense, thick mass of green filaments which grow from them; monothalamous and from 1.5-2 cm. in diameter. Mossy Rose Gall—*Rhodites rosae*—Plate E., fig. 4. Rose Carolina.

Large, round or oblong galls from 1 to 2 inches in length; reddish brown and covered with stout spines or prickles. Spiny Rose Gall—*Rhodites multispinosus* (Gill.)—Plate B., fig. 3. Rosa sp.

Spherical, covered with many prickly spines which vary in length, and are sometimes larger than the diameter of the gall. Internally it is hollow with the wall about 1 to 2mm. thick. Yellowish green, sometimes tinged with red. Soft and fleshy in summer, woody and brown in winter. It is found singly or in clusters of from two to ten or more, upon twigs of different kinds of wild roses. (Beutm.)—*Rhodites bicolor* (Harr.). Rosa sp.

Elongated swelling of the branch, gradually tapering at both ends. Smooth or densely covered with short spines. About 2 inches long and polythalamous. Long Rose Gall—*Rhodites dichlocerous* (Harr.). Rosa sp.

C.—*Galls on the roots.*

Large, irregularly rounded, reddish-brown galls from 1 to 2 inches in length; polythalamous. Rose Root Gall—*Rhodites radicum* (O.S.). Rosa sp.

Affecting Spiræa.

A pod-like gall formed by the folding of the leaf along the midvein. Spiræa Pod Gall—*Cecidomyia salicifolia*—Spiræa tomentosa, S. salicifolia and S. betulæfolia.

A bud-like, sessile gall in the axil of the leaf. Meadow Sweet Bud Gall—(Undescribed)—Spiræa salicifolia.

Small, cone-shaped galls on either the upper or lower surface of the leaf. Spiræa Cone Gall (Undescribed)—Spiræa salicifolia.

Affecting Sumac.

The leaf margin rolled tightly upward and inward on both sides. Sumac Leaf-margin Gall—*Eriophyes* sp.—Plate K., fig. 3. Rhus typhina.

Irregular, rounded, dimple gall, convex on the upper or under side of the leaf. Green to red or purple in color; inside clothed with white trichomes. Poison Ivy Dimple Gall—*Eriophyes* sp.—Plate G., fig. 5. Rhus radicans.

Large, smooth, rounded galls, somewhat resembling a tomato in shape, on the under sides of the leaves. Sumac Potato Gall—*Pemphigus rhois.* Rhus typhina.

Affecting Strawberry.

A much elongated, cylindrical enlargement of the petiole of the leaf, 1 to 4 in. long and 1-10 to 1-6 in. in diameter. Its surface, owing to slight annular constrictions has a more or less segmented appearance. The constrictions are seldom more than about .5 mm. deep and as a rule do not occur at regular intervals. Sometimes they are found every 1-16 of an inch, but in other cases they are as much as an inch apart. The surface of the gall is nearly red, or greenish, and is pubescent like the rest of the petiole. The texture is pulpy. The gall is polythalamous, as few as 10 and as many as 35 small chambers having been counted in specimens examined. These are all centrally situated and each contains a single, white larva, August 7, 1907. Occasionally two separate galls or gall clusters are found on a single petiole. Strawberry Petiole Gall. Plate R., fig. 7. Fragaria Virginiana.

Affecting Touch-me-Not.

Globular, succulent, semi-transparent, at base of flowers. Touch-me-not Flower Gall—*Cecidomyia impatiens* (O.S.). Impatiens fulva.

Green, succulent, globular or irregularly rounded swelling on the stem, petiole or leaf. Touch-me-not Stem and Leaf Gall—*Cecidomyia.* —Plate O., fig. 2. *fulva* (Bent)—Impatiens fulva.

Affecting Tulip Tree.

Hollow swellings, varying from 5 to 2.5 cm. in length on the midrib and lateral veins of the leaves. Tulip Tree Midrib Gall—*Cecidomyia tulipifera*—Liriodendron tulipifera.

Affecting Vervain.

An oval, hard and woody gall, an enlargement of the stem. Blue Vervain Stem Gall (Undescribed)— Verbena hastata.

AFFECTING VIBURNUM.

A small, blister-like gall, circular in outline, 3-4 mm. in diameter. Viburnum Leaf Blister Gall. Viburnum acerifolium.

AFFECTING VIRGINIA CREEPER.

Green and succulent fold gall on the midrib of the leaf. Midrib Gall on Virginia Creeper—*Cecidomyia* sp.—Plate E., fig. 7. Ampelopsis quinquefolia.

AFFECTING WHITE LETTUCE.

Large, rough, irregular swellings on stem. White Lettuce Stem Gall—*Aulax nabali* (Brodie)—Plate R., fig. 5. Prenanthes alba.

AFFECTING WILLOWS.

A.—*Galls on leaves.*

Smooth, fleshy, sessile, globular or slightly oval, monothalamous gall like a miniature apple. About 1 cm. in diameter growing on one side of the midrib of the leaf. Willow Apple Gall—*Pontania pomum*—Salix sp.

Smooth, flattish, glossy enlargements of the petiole or often of the midrib of the leaf near the base. Willow Petiole Gall—*Pontania desmodeoides*. Salix lucida.

Irregularly elongate-oval fleshy galls projecting equally on both surfaces of the leaf. Usually many on a leaf. Willow Flat Gall—*Pontania hyalina*—Salix sp.

Cluster of massed leaves surrounding a small cell containing a yellowish larva. Similar in appearance to the Goldenrod Bunch Gall. Willow Bunch Gall—*Rhabdophaga brassicoides*—Salix sp.

A pale green or purple capsule gall, projecting either above or below the leaf, or both; 1½ to 2 mm. in diameter. *Eriophyes* sp. Salix cordata.

Small, irregular, serrate and roughened pocket-galls or semi-capsules, green or red, strongly pilose above and thickly pubescent beneath. Usually on the upper side of the leaf. *Eriophyes* sp.—Plate K., fig. 4. Salix discolor.

Small, crimson pocket-galls or semicapsules on the upper side of the leaf. 1½ to 2½ mm. in diameter. *Eriophyes* sp. Salix amygdaloides.

A small capsule gall, irregularly hemispherical, greenish yellow, with a projecting aperture usually on the lower surface of the leaf, 1 to 2½ mm. in diameter. *Eriophyes* sp. Salix nigra.

Small irregular, serrate capsule-gall, green or red, usually on the upper side of the leaf; beneath sometimes impressed, more often projecting. 1 to 2 mm. in diameter. *Eriophyes* sp. Salix bebbiana.

Small irregular, serrate capsule-gall, projecting on both sides of the leaf, 1 to 2 mm. in diameter. *Eriophyes* sp. Salix petiolaris.

A bud deformation of the flower catkins and leaf buds or parts of leaves, producing a large, irregular, crumpled mass. *Eriophyes* sp.—Plate D., fig. 5. Salix nigra.

Rosette-like structures on the leaves and stems. Unsightly Willow Gall—*Eriophyes* sp. Salix sp.

This gall has two different forms in the course of its development. There is first the "bead" stage, when each gall looks like a small yellowish-white bead about 1.5 mm. in diameter, two-thirds of the bead appearing on the under and nearly one-third on the upper surface of the leaf. The tip of the bead, on the lower side of the leaf, is perforated. The texture is hard and close and the surface even and somewhat pubescent. The sec-

ond stage seems to occur in July. In this month the galls elongate on the lower surface into nipples 3-4 mm. long and 1-1.5 mm. in diameter. The color is rather lighter than before, except that the end of the nipple itself is often nearly black. The pubescence is much more visible than before. The galls occur either singly or in closely united groups of 2-15, chiefly along or near the midrib. They are monothalamous but no larvae were discovered in the specimens examined. Willow-leaf Bead and Nipple Gall—(Undescribed)—Salix rostrata.

B.—*Galls on stems.*

Large, rough galls on the stems of the Willow. The galls are smooth at first but become rough later in the season. Willow Branch Gall—*Saperda concolor*—Salix sp.

Cone-shaped mass of closely-imbricated leaves at the end of a twig, caused by the arrest of growth at the end of the stem. Pine Cone Willow Gall—*Cecidomyia strobiloides.*—Plate O., fig. 7. Salix sp.

Club-shaped gall formed on the lateral shoots of the Willow, an enlargement of the whole stem. About ¾ of an inch in length. Willow Club Gall—*Cecidomyia rigida*—Salix sp.

Oval galls on the sides of the twigs, hard and woody and usually the same colour as the stem.

Willow Egg Gall, *Euura ovum*—Salix sp.

Oblong-ovate, polythalamous galls, about the same color as the bark while young but gray when mature. Willow Potato Gall—*Rhabdophaga batatas* O.S.—Plate A., fig. 7. Salix sp.

Irregularly woody, oval enlargement of the stem at the joints or nodes. 1-3 to ½ an inch in length. Willow Joint Gall—*Rhabdophaga nodulus* (Walsh). Salix sp.

C.—*Galls of the Buds.*

Altered or transformed buds. The bud scales become elongated and the interior becomes a cavity in which the larva lives. Willow Bud Gall—*Rhabdophaga trilicoides* (Walsh). Salix sp.

Affecting Wild Lettuce.

An irregular, oval, polythalamous, knotty enlargement of the stem varying greatly in size. The interior is soft and pithy. Lettuce Tumor Gall—*Aulax tumidus*—Lactuca Canadensis.

Affecting Witch Hazel.

A conical swelling on upper side of leaf. Witch Hazel Cone Gall—*Hormaphis hamameliais* (Fitch).—Plate I., fig. 2. Hamamelis virginiana.

Round gall covered with long spines. A deformation of the fruit bud. Spiny Witch-Hazel Gall—*Hormaphis spinosus*—Plate I., fig. 1. Hamamelis virginiana.

Affecting Wood Nettle.

Ball-like galls occurring either on the upper or lower surface of the leaf. Wood Nettle Ball Gall—*Cecidomyia urnicola*—Plate F., fig. 3. Laportea Canadensis.

A gall consisting of a malformation of the fruit, much like the ball gall on the leaves. Wood Nettle Fruit Gall—*Cecidomyia* sp.—Laportea Canadensis.

Soft, smooth, spongy, oval or rounded gall of a pale brown colour, on the stem. About 1 cm. in diameter. Wood Nettle Pod Gall—(Undescribed). Laportea Canadensis.

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PLATE I.

1. Spiny Witch-Hazel Gall. (*Hormaphis spinosus.*)
2. Witch-Hazel Cone Gall. (*Hormaphis hamamelidis.*)
3. Cottonwood Petiole Gall. (*Pemphigus populicaulis.*)
4. Hickory Cone Gall. (*Phylloxera caryae-fallax.*)
5. Cockscomb Gall on Elm. (*Colopha ulmicola.*)
6. Basswood Mite Gall. (*Eriophyes abnormis.*)

PLATE J.

1. Soft Maple Mite Gall. (*Phloecoptes quadripes*).
2. Two specimens on left. (*Eucosma scudderiana.*)
3. Two specimens on right. (*Trypeta solidaginis.*)

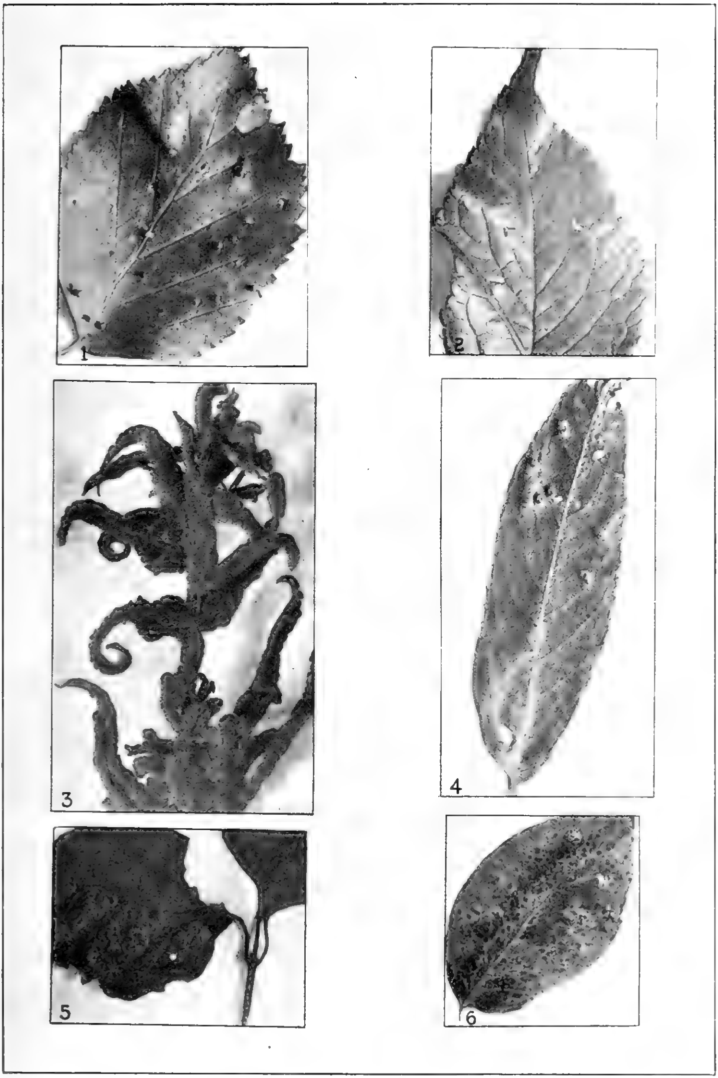

PLATE K.

1. Eriophyes sp., Betula papyrifera.
2. Eriophyes sp., Prunus Americana.
3. Eriophyes sp., Rhus Cotinus.
4. Eriophyes sp., Salix discolor.
5. Eriophyes cephalanthae, Cephalanthus occidentalis.
6. Eriophyes pyri sp., Pyruis communis.

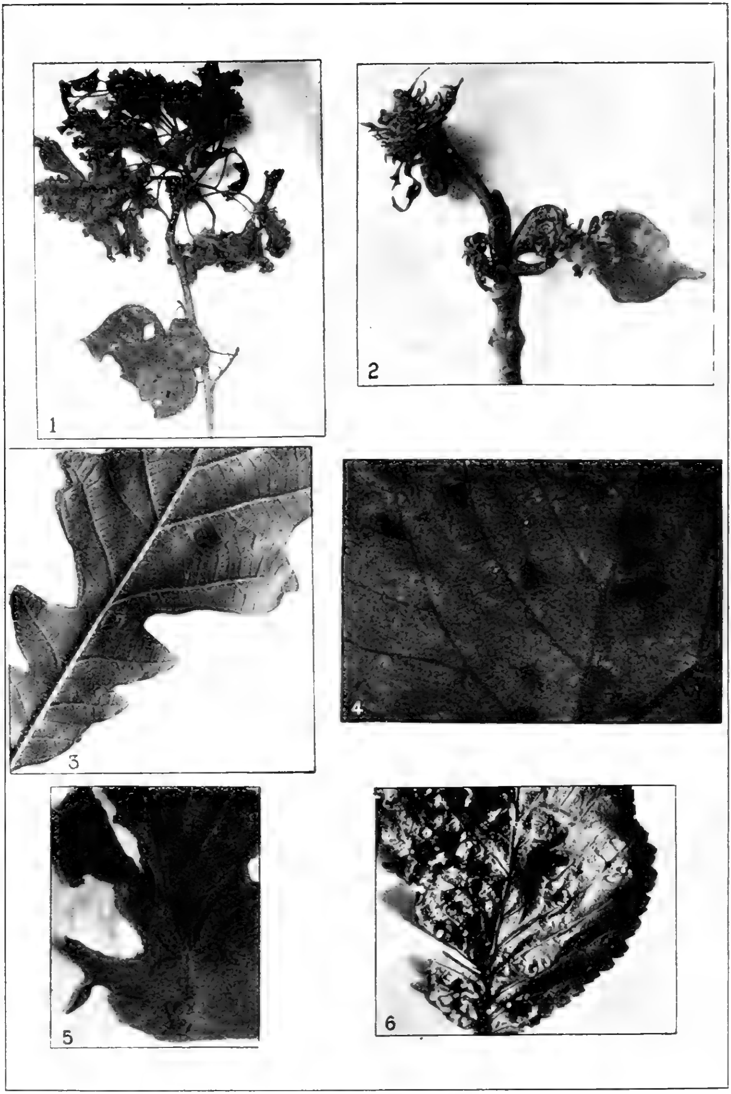

PLATE L

1. Eriophyes sp., Populus tremuloides.
2. Eriophyes sp., Fraxinus Americana.
3. Eriophyes sp., Quercus macrocarpa.
4. Eriophyes sp., Vitis sp.
5. Eriophyes sp., Ulmus Americana.
6. Eriophyes sp., Ulmus pubescens.

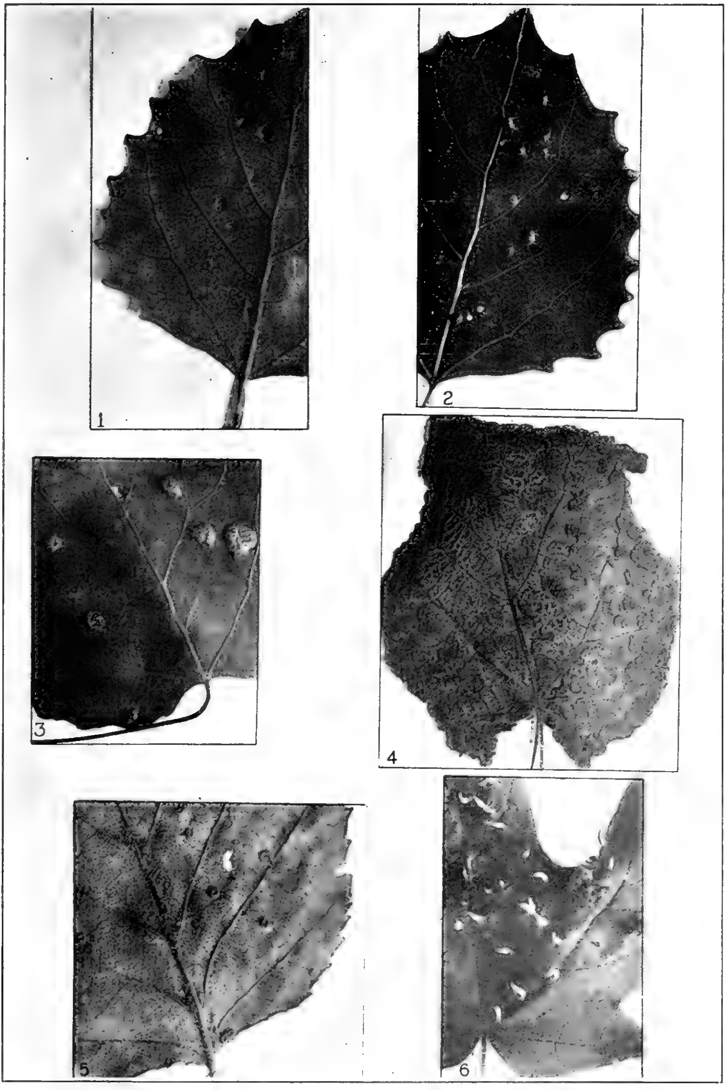

Plate M.

1. Eriophyes sp., (under surface) Populus grandidentata.
2. Eriophyes sp., (upper surface) Populus grandidentera.
3. Eriophyes sp., Populus tremuloides.
4. Eriophyes sp., Tilia Europea.
5. Eriophyes sp., Betula papyrifera.
6. Phlœcoptes aceris, Acer saccharum.

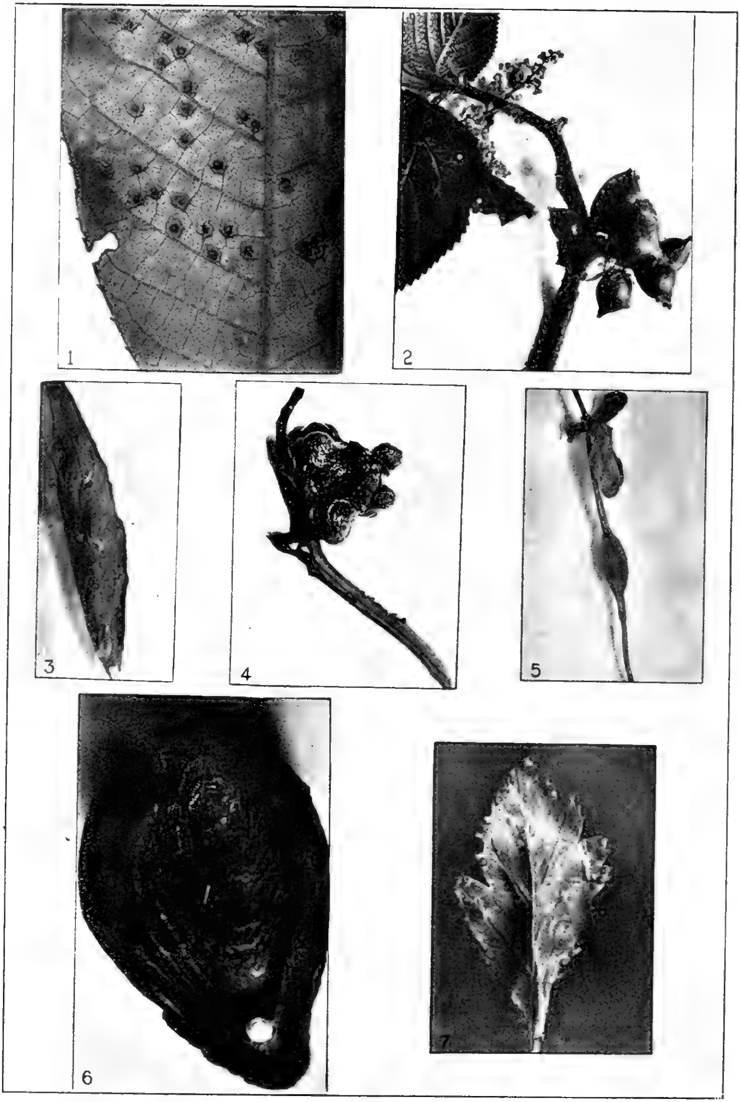

PLATE N.

1. Hickory Gall.
2. Pod or fruit gall, Laportea Canadensis.
3. Golden Rod seed gall, Solidago Canadensis.
4. Cecidomyia caryae-nucicola, Carya alba.
5. Lasioptera lycopi, Lycopus virginicus.
6. Cecidomyia virginiana, interior of gall, Prunus virginiana.
7 Hawthorn Leaf-border gall, Crataegus sp.

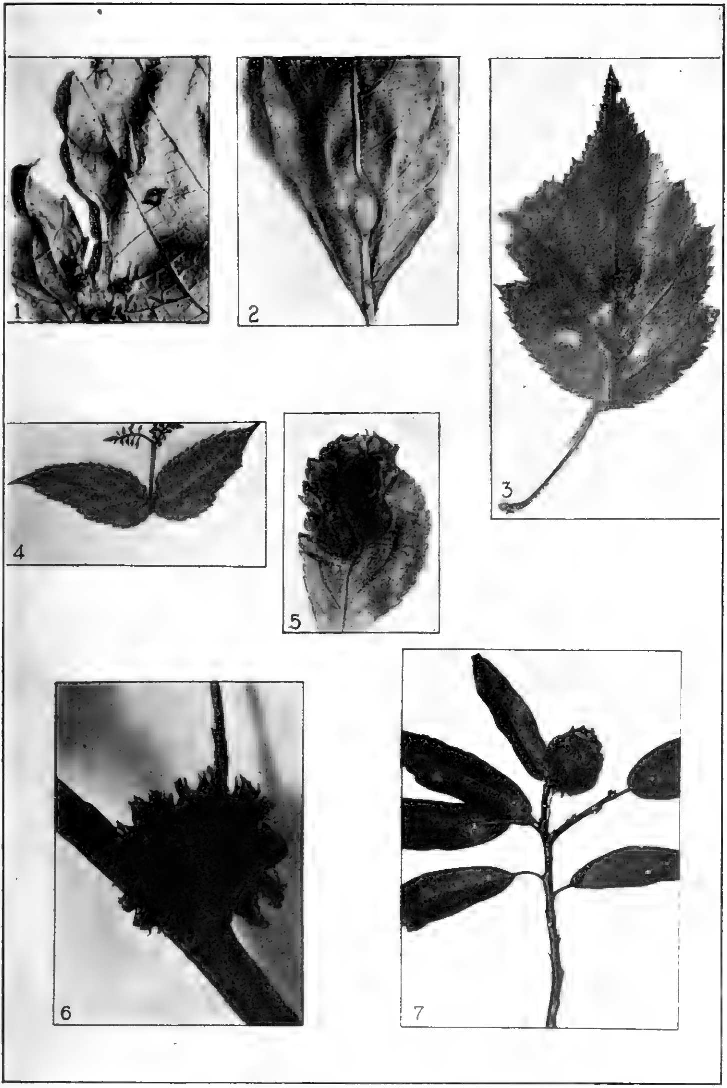

Plate O.

1. Cecidomyia viticola, vitis sp.
2. Cecidomyia sp., Impatiens fulva.
3. Cecidomyia bedeguar, Ceataegus.
4. Cecidomyia? collinsoniae, Collinsonia Canadensis.
5. Hawthorn Bladder gall, Crataegus, sp.
6. Gooseberry Bud gall, Ribes grossulare.
7. Cecidomyia Strobiloides. Salix discolor.

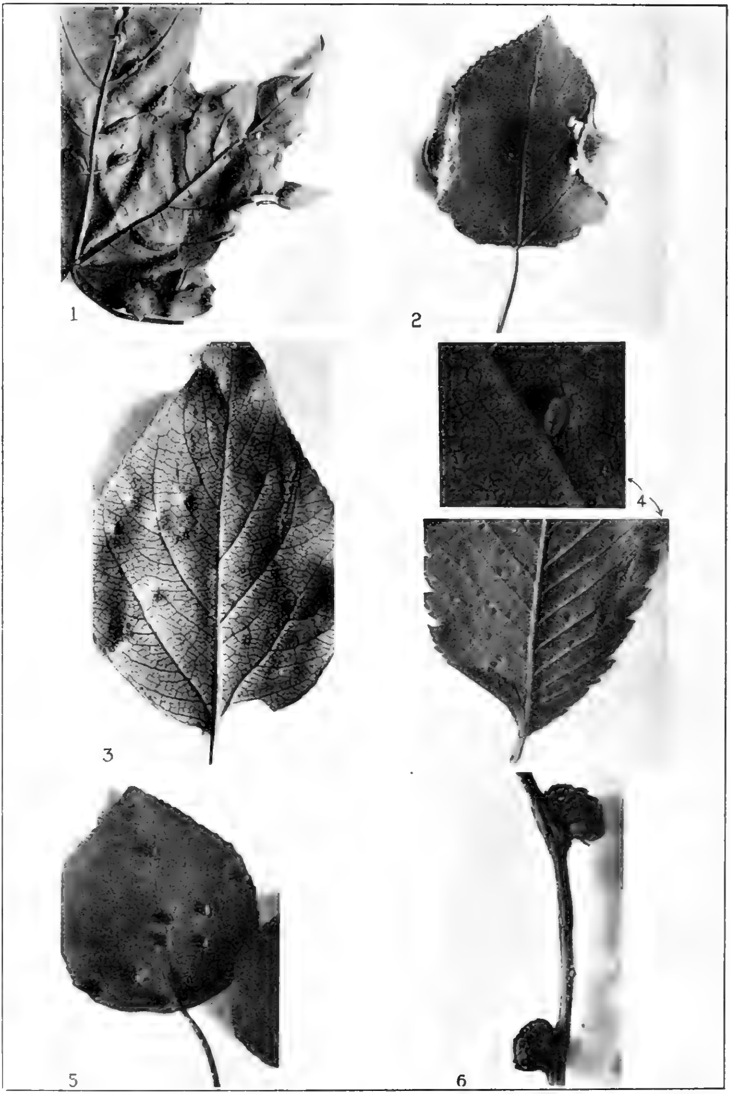

Plate P.

1. Maple Vein gall, Acer Saccharum.
2. Aspen Tent gall, Populus tremuloides.
3. Balm of Gilead pimple gall, Populus balsamifera.
4. Elm-Pimple gall, Ulmus Americana.
5. Aspen Ball gall, Populus tremuloides.
6. Red Elm Bud gall, Ulmus fulva.

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A Cocks-comb Gall on Rhus microphyla. Psyche, 6:504-505.
On a Fleshy Leaf Gall on Scrub Oak. Psyche, 6: 523.
A Cone-like Cecidomyid Gall on Bigelovia. Psyche, 7:176.
A Psyllid Leaf-Gall on Celtis. Probably Pachypsylla celtidis-pubescens, Riley. Psyche, 7:187-188.
Gall of Eurytoma sp. on the Cat's-claw Thorn. Psyche, 7:202-203.

B. D. WALSH.

Walsh, 1864, 1867. On the Insects, Coleopterous, Hymenopterous and Dipterous Inhabiting the Galls of Certain Species of Willow. Entomological Society of Philadelphia Proceedings, 3:543-644; 6:223-88.
On the Genera of Aphididæ found in the United States. Proc. Ent. Soc., Phil., Vol. I., No. 9, p. 294.
On Dimorphism of the Hymenopterous genus, Cynips, with appendix, containing lists for a new classification of Cynipidæ and a list of Cynipidæ, including description of several species inhabiting the Oak Galls of Illinois. Proc. Ent. Soc., Phil., Vol. II., No. 4, pp. 445-500.

ENTOMOLOGICAL RECORD 1908.

By James Fletcher and Arthur Gibson.

The season of 1908 in most parts of Canada was an exceptionally dry one. The continued drought which began in early June, lasted well on into September in many parts of the Dominion. The weather, too, was extremely hot, and vegetation, consequently, was much injured and reduced in vigour. Insects have been particularly numerous in certain localities, and some kinds of injurious species were very destructive. From the collector's standpoint, the season, on the whole, throughout the country, was probably better than that of each of the three or four preceding years. Some correspondents report that the season in their immediate vicinity has been a particularly poor one, others that it has been an improvement on the recent years. More are of the latter opinion.

As in the past a great many records have been sent in by correspondents. From these have been taken those which, for one reason or another, have been thought to be of most interest. As has been pointed out before, an insect may seem rare to the collector who sends in the record, when in reality, its occurrence may be widerspread, and for this reason not worth recording in the Record.

As in previous years, some of the federal Government officers brought back with them, from their distant fields of labour, small collections of insects of special interest. Mr. Joseph Keele, during the past summer, made some valuable collections at the mouth of the Gravel River and along the McKenzie River adjacent, on the eastern slope of the Rockies. Mr. C. H. Young, of the same Department, spent the months of August and September at the Biological Station, Departure Bay, B.C., with the well-known lepidopterist, Rev. G. W. Taylor, who is now there as Curator of the Station. Mr. Young collected insects of several orders, among which are many of much interest. Mr. Douglas H. Nelles, of the Alaska Boundary Survey, spent the summer in the Yukon District, between White Horse and the 141st Meridian, and made a collection of butterflies. Mr. Andrew Halkett of the Fisheries Museum, returned to Ottawa in November, bringing with him a small collection of various insects taken in Alberta. Dr. Fletcher made a hurried trip to British Columbia in September and October, and while stopping over for a day or two, each at Nepigon, Ont.; Regina, Sask.; Banff and Laggan, Alta.; and Departure Bay, B.C., collected many insects of value. Mr. Gibson spent most of July at Youghall, N.B., and while there made collections in all orders.

Acknowledgments are again due to the leading specialists in the United States who have rendered much help to Canadian students during the year: Dr. L. O. Howard, with his assistants at Washington; Dr. J. B. Smith, of New Brunswick, N.J.; Professor H. F. Wickham, of Iowa City, Iowa; Mr. W. D. Kearfott, of Montclair, N.J.; Mr. E. P. Van Duzee, of Buffalo, N.Y.; Mr. Wm. Beutenmuller and Professor R. C. Osburn, of New York, N.Y., and Prof. J. S. Hine, of Columbus, Ohio. Sir George Hampson, of the British Museum, has also been of much help in identifying specimens of lepidoptera.

N.B.—Owing to the death of my good friend, chief, and ever kind teacher, Dr. James Fletcher, the manuscript of the Entomological Record for 1908 has had to be prepared by me. Dr. Fletcher had, I know, certain records and other notes which he intended to include. I trust, however, that any omissions which may be noticed will be made known, so that they can be included in the Entomological Record for 1909.—*Arthur Gibson.*

LITERATURE.

Among the many valuable publications which have been received during the past year, and which are of interest to Canadian students, mention may be made of the following:—

BANKS, NATHAN. Catalogue of the Neuropteroid Insects (except Odonata) of the United States. Philadelphia: Transactions, American Entomological Society, 1907. This valuable catalogue of neuropteroid insects was not received in time to be mentioned in last year's Record. The name of the author is sufficient to guarantee the usefulness of this list. Altogether there are nearly 900 species included in the catalogue, arranged under 210 genera.

BETHUNE, C. J. S. Bibliography of Canadian Entomology for the year 1907. Ottawa: Transactions of the Royal Society of Canada, Third Series—1908-1909, Volume II., Section IV.; separate received December 15, 1908. This paper, which is annually presented to the Royal Society of Canada by the Rev. Prof. Bethune, is a most useful publication. In the above bibliography, 125 references are made to contributions which have appeared during 1907, all of which are of value to Canadian students. With each reference a short explanatory statement is made. We are very grateful to the author for this annual publication. To many, it is the only source of reference to articles which have appeared during the year on Canadian Entomology.

BUSCK, AUGUST. A Generic Revision of American Moths of the Family Œcophoridæ, with Descriptions of New Species. Proc. U.S. Nat. Museum, Vol. XXXV., pp. 187-207; published Oct. 31, 1908. The results of Mr. Busck's work on Microlepidoptera are always of much value. In this paper the genera of the above family are treated of. As very little study had previously been given to the North American species, this contribution will be of great service to students of Tineid moths. Mr. Busck states that there are now 121 described species of this family represented in North America.

BRADLEY, J. CHESTER. The Evaniidæ, Ensign-flies, an Archiac Family of Hymenoptera. Trans. Amer. Ent. Soc., Vol. XXXIV., No. 2, April-May-June, 1908; pp. 101-194, 11 plates. This contribution deals with the North American species of Evaniidæ, insects which are usually not well represented in collections. References to species occurring in Canada are given and many new forms described. This paper will prove of much use to hymenopterists. The Ensign-flies, which are so named because they carry the abdomen aloft like a flag, are parasitic.

CAUDELL, ANDREW NELSON. Notes on some Western Orthoptera, with the Description of one New Species. Proc. U.S. Nat. Museum, Vol. XXXIV, pages 71-81; published April 17, 1908. As this paper includes notes on species collected in western Canada in 1906, it will prove of value to those of our entomologists who study orthoptera. 27 different species are recorded, from British Columbia, Alberta and Saskatchewan.

FERNALD, C. H. The Genera of the Tortricidæ and their Types. Amherst, Mass.; published by the author, June, 1908. Professor Fernald is to be congratulated on this most valuable piece of work. Over 300 generic names are reviewed. In the *Canadian Entomologist*, Sept. 1908, Mr. Kearfott says: "This work is the first of its kind that has ever been published in the Microlepidoptera. As its title implies, it takes up one by one every Tortricid genus known to the author, from the tenth edition of Linnæus down to the present day, and fixes and names the type species in each genus."

HARRINGTON, W. HAGUE. Fauna Ottawensis: Hymenoptera—Superfamily III.—Vespoidea; The Ottawa Naturalist, July, 1908. This contribu-

tion to the insects of the Ottawa District is a most welcome one. Mr. Harrington has always paid special attention to the fauna of this locality, and, as our highest Canadian authority on the hymenoptera, the above paper, which mentions 87 different species, is of much value. In the introductory remarks information is given on the Families Ceropalidæ, Vespidæ, Eumenidæ, Chrysididæ, Bethylidæ, Tiphiidæ, Thynnidæ, Myromosidæ and Mutillidæ.

Kearfott, W. D. Descriptions of New Species of North American Crambid Moths. Proc. U.S. Nat. Museum, Vol. XXXV., pp. 367-393; separates published Oct. 31, 1908. In this valuable contribution to the Pyralidæ, 20 new North American species of crambid moths are described, 5 of which are from Canada.

Knab, Frederick. Observations on the Mosquitoes of Saskatchewan. Reprinted from Smithsonian Miscellaneous Collections (Quarterly Issue), Vol. 50; published Feb. 20, 1908. These observations were the result of an expedition to western Canada during the spring of 1907. Nine different species were collected, eight of the genus *Aedes* and one of the genus *Culiseta*. The habits of some of the species are discussed, and notes given on their life-histories.

Mitchell, Evelyn Groesbeeck. Mosquito Life. J. P. Putnam's Sons, New York and London. The Knickerbocker Press, (1907). This most interesting and extremely valuable book came to hand early in 1908. It reviews previous work on these important insects, and includes much original matter not previously published. The titles of the different chapters will give an idea of the extent of the work. I. Systematic Position and Structure. II. Some Habits of the Adults. III. How Far Mosquitoes Fly. IV. Mating. V. Larvæ and Pupæ. VI. Malaria. VII. Yellow Fever and Other Diseases. VIII. Mosquito Remedies and Enemies. IX. Notes on the Commoner Species. X. Collecting and Laboratory Methods. XI. Identification Keys and Systematic List.

Osburn, Raymond C. British Columbia Syrphidæ, New Species and Additions to the List. Canadian Entomologist, January, 1908. In this paper, 50 different species are mentioned, 6 of which are described as new. This article brings the list of British Columbian Syrphidæ up to 128 different species. It is pleasing to note that the large majority of the species were collected by local entomologists. This and Mr. Osburn's previous paper, (Can. Ent., Vol. XXXVI., Aug.-Sept., 1904), will make an excellent foundation for future work, in this family, for British Columbian dipterists.

Smith, John B. Notes on the Species of Amathes, Hbn., Philadelphia: Transactions, American Entomological Society, XXXIII., Nov. 1907; separate received Feb. 3, 1908. This paper, which treats of some of the North American species of noctuids in our lists under the genus *Orthosia*, is a welcome addition to the literature. Ten species of the genus *Amathes* have been found in Canada. This genus has the "Proboscis fully developed; palpi obliquely porrect, fringed with long hair in front, the 3rd joint short; frons smooth; eyes large, rounded; antennæ of male typically ciliated; head and thorax clothed with hair only; the tegulæ produced to a dorsal ridge, the pro- and metathorax without distinct crests; abdomen dorsally flattened, with lateral tufts of hair and some rough hair at base but without crests. Forewings with the termen evenly curved."

Smith, John B. A Revision of Some Species of Noctuidæ heretofore referred to the Genus Homoptera, Boisduval. Proc. U. S. Nat. Museum, Vol. XXXV., pp. 209-275, separates published November 10, 1908. This important contribution on the old genus Homoptera will be hailed with delight

by lepidopterists. There has been so much confusion in the genus, and it was previously very difficult, in many instances, to get exact determinations. Dr. Smith has gone into the subject very fully. Of the 25 species treated of, nine are recorded from Canada. In addition four other species occur in Canada, as mentioned in the *Ottawa Naturalist*, October, 1908. The old name Homoptera is replaced by Phœocyma of Hubner, an earlier name.

VAN DUZEE, E. P. Studies in North American Membracidæ. Bulletin of the Buffalo Society of Natural Sciences, Vol. IX., pp. 29-129; issued April 18, 1908. This publication will prove of much value to hemipterists. Most of the Membracidæ, or "tree-hoppers," are of uncommon occurrence, and for that reason, probably, the family has not been very much studied. The author gives tables of the sub-families, genera and species, and, at the end, a list of all species known to occur north of the southern boundary of the United States.

The following is a list of the names and addresses of collectors heard from during 1908:—

Anderson, E. M., Provincial Museum, Victoria, B.C.
Baird, Thomas, High River, Alta.
Baldwin, J. W., 74 Besserer Street, Ottawa.
Bethune, Rev. Prof., O. A. C., Guelph.
Boulton, A. R. M., c/o King Brothers, Quebec, Que.
Brodie, Dr. W., Provincial Museum, Toronto.
Bush, A. H., 1105 Ninth Ave., Vancouver, B.C.
Chagnon, Gus., Box 186, Montreal.
Cockle, J. W., Kalso, B.C.
Criddle, Norman, Treesbank, Man.
Dawson, Horace, Hymers, Ont.
Day, G. O., Duncans, B.C.
Denny, Edward, 200 Mitcheson Street, Montreal.
Dent, W. A., Sarnia, Ont.
DeWolfe, L. A., Penticton, B.C.
Dod, F. H. Wolley- Millarville, Alta.
Evans, J. D., Trenton, Ont.
Fletcher, James, Experimental Farm, Ottawa.
Fyles, Rev. T. W., Levis, Que.
Gibson, Arthur, Experimental Farm, Ottawa.
Groh, H., Experimental Farm, Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Halkett, A., Fisheries Museum, Ottawa.
Hanham, A. W., Duncans, B.C.
Harms, J. F., Treesbank, Man.
Harrington, W. H., P.O. Department, Ottawa.
Harvey, R. V., Victoria, B.C.
Heath, E. F., Cartwright, Man.
Hudson, A. F., Millarville, Alta.
Jarvis, T. D., O. A. C., Guelph.
Keele, Jos., Geological Survey, Ottawa.
Keen, Rev. J. H., Metlakatla, B.C.
Létourneau, Jos. A., Exp. Farm, Ottawa.
Lyman, H. H., 74 McTavish Street, Montreal.
Marmont, L. E., 2553 Second Ave. West, Vancouver, B.C.
McIntosh, W., St. John, N.B.

Metcalfe, W., 288 Bank Street, Ottawa.
Moore, W. H., Scotch Lake, N.B.
Moore, G. A., 209 Prince Arthur Street, Montreal.
Morris, Frank, Port Hope, Ont.
Nelles, Douglas H., Dept. Interior, Ottawa.
Perrin, Jos., McNab's Island, Halifax, N.S.
Ross, Ernest, Port Arthur, Ont.
Russell, John, Digby, N.S.
Sanson, N. B., Banff, Alta.
Saunders, Henry, 21 Harbord Street, Toronto.
Sherman, R. S., 2285 Sixth Ave., Vancouver, B.C.
Simpson, W., Dom'n Observatory, Ottawa.
Swaine, J. M., Macdonald College, Que.
Taylor, Rev. G. W., Departure Bay, B.C.
Tipping. E. Dalton, Bluff Centre, Alta.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., 99 St. George St., Toronto.
Wallis, J. B., Machray School, Winnipeg, Man.
Willing, T. N., Regina, Sask.
Wilmot, E. S., Vernon, B.C.
Wilson, W. J., Geological Survey, Ottawa.
Winn, A. F., 132 Springfield Ave., Westmount, Que.
Young, C. H., Geological Survey, Ottawa.
Zavitz, E. J., O. A. C., Guelph, Ont.

NOTES OF CAPTURES.

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U.S.N.M. Bull. No. 52).

RHOPALOCERA.

(Dyar's number).

20. *Papilio indra* Reakirt, a. *nitra* Edw. Bluff Centre, Alta., (Tipping).
23. *Lærtias philenor* L. Grimsby, Ont., larva, Aug. 9, (J. W. Daniel).
92. *Euptoieta claudia* Cram. Toronto, "Humber Road, Old Mill," July, (Hahn).
104. *Argynnis electa* Edw. Hope Mts., B.C., not common, July 17, (Sherman).
134. *Brenthis triclaris* Hbn. Mer Bleue, near Ottawa, June 6, three specimens, (Young, Criddle, Gibson).
158. *Lemonias taylori* Edw. Hope Mts., several taken at summit, 5,800 feet, July 20, (Sherman, Harvey, Day).
189. *Phyciodes tharos* Dru. Hope Mts., July 21-23, (Sherman, Harvey, Day). A fine specimen of the aberration *packardii* Saund., was taken at the Mer Bleue, near Ottawa, by Mr. Young.
190. *Phyciodes batesii* Reakirt. On railway track, between Cache Bay and Beaver Meadow, Hull, Que., June 13, (Gibson).
223. *Junonia coenia* Hbn. Orillia, four specimens in two days. It looks as if this butterfly had become a permanent resident, (Grant). Toronto, August, (Miss F. Hahn).

271. *Erebia vidleri* Elwes. Hope Mts., July 20, (Day).
376. *Incisalia henrici* G. & R. A specimen of this butterfly taken at Montreal by the late Mr. Caulfield has recently been identified by Mr. Cook, who says it is the furthest northern record.
584. *Epargyreus tityrus* Fab. Cartwright, Man., one in garden, June 19, second appearance here, (Heath).

HETEROCERA.

678. *Pholus pandorus* Hbn. Ottawa, larva on Virginian Creeper, moth emerged July 8, (Gibson).
747. *Tropæa luna* L. Winnipeg, Man., June 1, (Wallis). Mr. Wallis also reports that a specimen of this rare moth was taken some years ago at Gall Harbour, (Miss Cowley).
836. *Utetheisa bella* L. Hyde Park, Ont., one specimen, end August, (J. F. Weir); Hymers, Ont., Sept. 19, (Dawson).
853. *Estigmene prima* Slosson. Winnipeg, June 2, two specimens, (Wallis).
861. *Phragmatobia assimilans* Wlk., a. *franconia* Slosson, Hymers, June 9, (Dawson).
868. *Neoarctia beanii* Neum. Larva from N. B. Sanson, found on Sulphur Mountain. Moth emerged at Ottawa, June 15, (Gibson).
872. *Hyphoraia parthenos* Harr. Ottawa, a fine specimen, at light, July 1, (Baldwin). Rare at Ottawa.
874. *Apantesis virgo* L., a. *citrinaria*, N. & D., Toronto, (Hahn).
888. *Apantesis nevadensis* G. & R., b. *superba* Stretch. Hope Mts., July 20, (Sherman). Penticton, B.C., (Wallis).
889. *Apantesis williamsii* Dodge, a. *determinata*, Neum., July 7, (Dawson), first Ontario record.
890. *Apantesis phyllira* Dru. Toronto, (Hahn).
1,000. *Apatela quadrata* Grt. Hymers, June 22, (Dawson); Orillia, (Grant).
Apatela inclara Sm. Billings Bridge, Ottawa, (Fletcher). New record for district.
1,034. *Apatela perdita* Grt. Peachland, B.C., July 8, (Wallis).
1,047. *Apharetra pyralis* Sm. Aweme, Aug. 28, (E. Criddle).
1,075. *Baileya doubledayi* Gn. Ottawa, July 20, (Baldwin).
1,084. *Catabena lineolata* Wlk. Ottawa, July 20, (Baldwin). First record for the district.
1,088. *Platysenta videns* Gn. Cartwright, Man., one, July 4, always rare, (Health); Ottawa, June 6, (Gibson).
1,165. *Hadena diversicolor* Morr. Sudbury, (Evans).
1,176. *Hadena didonea* Sm. Trenton, (Evans).
1,216. *Hadena contradicta* Sm. Hymers, June 22, (Dawson). First record received for Ontario.
1,229. *Hadena alticola* Sm. Metlakatla, B.C., (Keen).
Hadena multicolor Dyar. Victoria, B.C., May 22, (Harvey).
1,255. *Macronoctua onusta* Grt. Trenton, four specimens, Sept. 17, 18, 20, 25, (Evans). Larva again found at Ottawa, (Gibson).
1,341. *Oncocnemis atrifasciata* Morr. Hymers, Aug. 22, (Dawson).
Rhynchagrotis sambo Sm. Ainsworth, B.C., Aug. 3, 11, (Rev. G. H. Findlay); Kaslo, July and August, (Cockle); Peachland, July, (Wallis).
1,412. *Adelphagrotis stellaris* Grt. Victoria, July 26, (Anderson); Duncans, (Hanham).

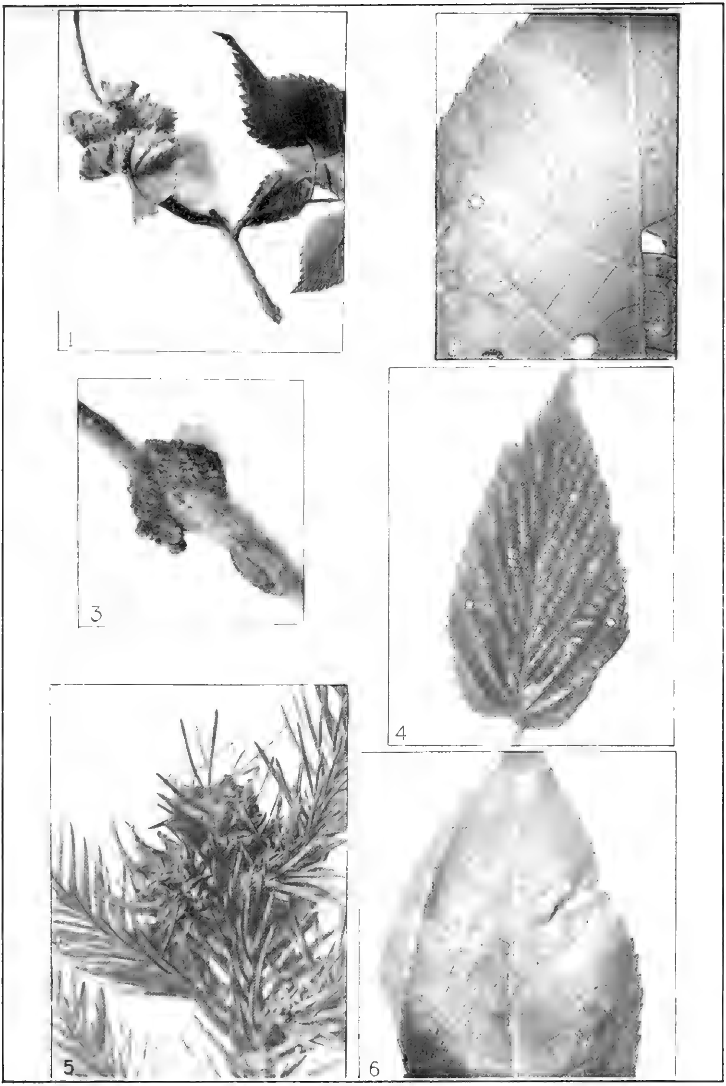

Plate Q.

1. Schizoneura Americana, Ulmus Americana.
2. Phylloxera sp., Carya alba.
3. Schizoneura sp., Populus tremuloides.
4. Schizoneura sp., Alnus incana.
5. Chermes abietis, Picea excelsa.
6. Phylloxera caryaevena, Carya ovata.

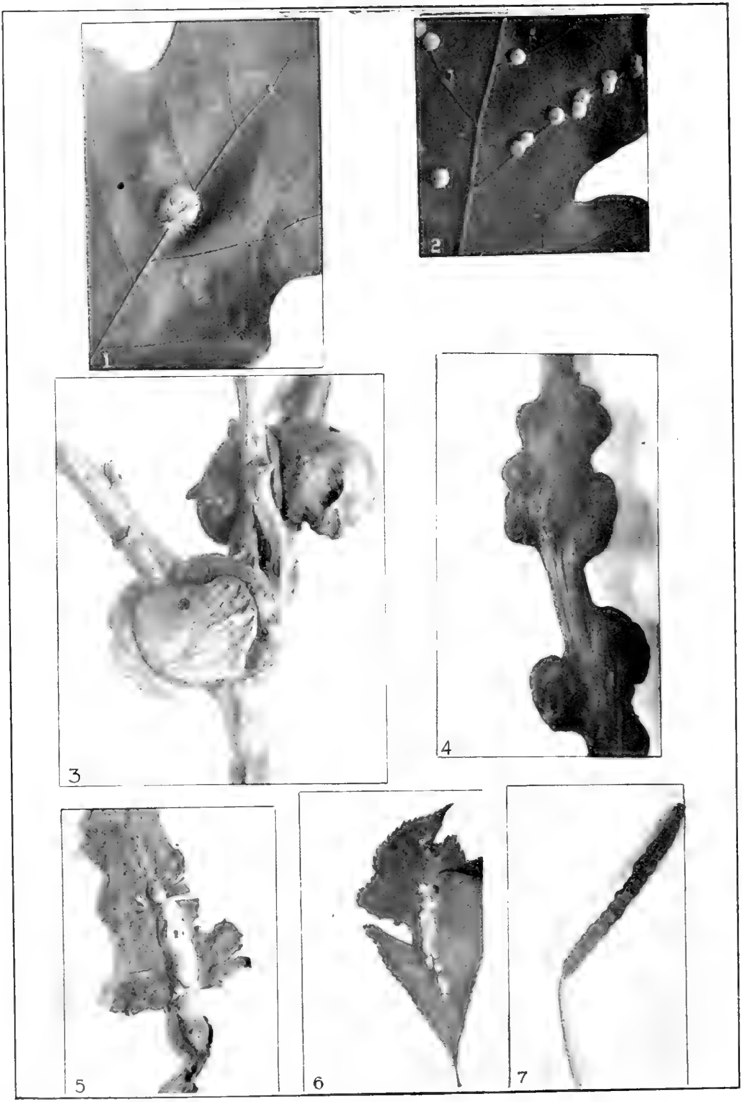

PLATE R.

1. Acraspis erinacei, Quercus alba.
2. Neuroterus floccosus, Quercus alba.
3. Andricus ventricosus, Quercus sp.
4. Aulax nabali, Prenanthes alba.
5. Gilletia taraxaci, Taraxacum officinale.
6. Cecidomyla holotricha, Carya ovata.
7. Strawberry Peticle gall Fragaria virginiana.

THE LATE JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.

1,430. *Pachnobia monochromatea* Morr. Ottawa, July 3, (Young).
1,431. *Pachnobia littoralis* Pack. Hymers, June 22, (Dawson). Only Ontario record we have.
1,434. *Pachnobia wockei* Moeschl. Labrador, July 19, (Dr. A. P. Low).
Setagrotis dolens Sm. High River, Alta., (Baird).
1,455. *Agrotis geniculata* G. & R. Meach Lake, Que., near Ottawa, Aug. 31, (Fletcher); Truro, N.S., (DeWolfe); Toronto, (Gibson).
Rhizagrotis perolivalis Sm. High River, Aug. 25, (Baird).
1,544. *Feltia gladiaria* Morr. Trenton, (Evans). This is the first Canadian specimen we have seen.
1,600. *Paragrotis perfusca* Grt. Sudbury, Ont., (Evans).
1,682. *Paragrotis fuscigera* Grt. Olds, Alta., June 21, (Willing).
1,697. *Paragrotis dissona* Moesch. Aweme, Aug. 28, (E. Criddle).
Paragrotis cocklei Sm. Departure Bay, Aug. 7, (Young).
1,780. *Mamestra determinata* Sm. Trenton, at light, Aug. 27, (Evans).
1,783. *Mamestra detracta* Wlk. Trenton, July 31, (Evans).
1,789. *Mamestra capsularis* Gn. Among some noctuids named for Mr. Evans, was a specimen of this moth with the label "E. Ontario, Canada," on it. This is the first Canadian record we have.
1,797. *Mamestra gussata* Sm. Ottawa, April 24, (Young).
1,821. *Mamestra rugosa* Morr. Sudbury, (Evans).
1,825. *Mamestra goodellii* Grt. Peachland, B.C., July 18, (Wallis); Ottawa, July 24, (Saunders); Sidbury, (Evans); Mt. St. Hilaire, near Montreal, May 24, (Chagnon).
1,840. *Mamestra sutrina* Grt. Laggan, Aug. 4, (Fletcher).
1,894. *Xylomiges dolosa* Grt. Hymers, May 10, (Dawson).
2,024. *Graphiphora furfurata* Grt. Mt. St. Hilaire, near Montreal, July 2, (Chagnon). The true species (J. B. S.).
2,074. *Pleroma bonuscula* Sm. Victoria, (Fletcher). A new locality for the species, (J. B. S.).
2,108. *Xylina bayleyi* Grt. Duncans, B.C., April, (Day).
Hydrœcia micacea Esp. Specimens of this moth have been reared in the Division from larvæ received from Mahone Bay, N.S., (C. A. Hamilton); Westport, N.S., (Geo. Welch), and Tramore, Ont., (Capel B. St. George). As mentioned in Mr. Gibson's paper, in this report, the above and specimens of the moth taken at St. John, N.B., by Mr. W. McIntosh, and recorded by him under the name of *Hydrœcia medialis* Sm., are the only American records of this European insect.
2,214. *Tapinostola variana* Morr. Trenton, at light, Aug. 6, (Evans); Westbourne, Man., July 28, (Wallis).
Amathes duscata Sm. Aweme, Aug. 28, (E. Criddle).
Amathes acta Sm. Departure Bay, B.C., Sept. 5, (Young).
2,224. *Orthosia inops* Grt. Cartwright, Man., July 30, (Heath); Aweme, Aug. 25, (Fletcher); Aug. 30, (E. Criddle).
2,231. *Orthosia lutosa* Andrews, Peachland, B.C., July 6, (Wallis).
Orthosia verberata Sm. Bartlett Bay, off Glacier Bay, Alaska, June 10, (Nelles). A new locality for the species. (J.B.S.).
2,280. *Pippona bimatris* Harv. Aweme, (Fletcher). Quite a rare species. First Canadian record.
2,390. *Dasyspoudœa meadii* Grt. High River, Alta., (Baird).
2,423. *Heliaca nexilis* Morr. Several on summit of Hope Mts., B.C., July 20, (Harvey).

2,617. *Eustrotia includens* Wlk. Trenton, July 18, (Evans).
2,618. *Galgula hepera* Gn. and var. *partita* Gn. Mt. St. Hilaire, near Montreal, Aug. 30, (Chagnon). Mr. Winn has also taken the species at Montreal.
2,661. *Tarache terminimacula* Grt. Trenton, (Evans).
2,769. *Meliopotis limbolaris* Geyer. Lorne Park, Ont., July 25, (Williams).
2,830. *Catocala concumbens* Wlk. Metlakatla, B.C., (Keen); Fort Selkirk, Yukon, July, (Miss Seymour). Both of these records are of much interest; the latter is the most northern limit of *concumbens* known at the present time, (Beut.).
2,858. *Catocala coccinata* Grt. Westbourne, Man., Aug. 10, (Wallis).
2,871. *Catocala subnata* Grt. Billings Bridge, Ottawa, (Fletcher). First record for the district.
2,900. *Catocala prœclara* G. & R., Digby, N.S., Sept. 17, (Russell).
Homoptera norda Sm. Chelsea, Que., near Ottawa, May 30, (Gibson); Ottawa, May 16, 18, (Young); Kaslo, (Cockle); Cartwright, (Heath).
2,900 *Homoptera minerea* Grt. Britannia, near Ottawa, June 20, (Baldwin). In the Entomological Record for 1906, this species is recorded from White River, Hudson Bay Slope, June 2, (Wilson). On further examination Dr. Smith could not confirm this identification, as the specimen was much rubbed and crushed.
2,991. *Homoptera calycanthata* S. & A. In the Entomological Record for 1904, this species is recorded from Kaslo. According to Dr. Smith's Revision of the Genus Homoptera, just published, this record should now refer to his new species *norda*.
3,000 *Homoptera unilineata* Grt. Winnipeg, June 2, (Wallis). Only Canadian record which we have.
3,002. *Homoptera duplicata* Bethune. As mentioned in the Ottawa Naturalist, Oct. 1908, the record of this moth having been taken at Wellington, B.C., (Taylor), should now refer to *largera* Sm. *Duplicata* has been taken at Digby, N. S., (Russell), and Truro, N.S., (DeWolfe).
Homoptera helata Sm. Britannia, near Ottawa, June 20, (Baldwin).
3,038. *Philometra hanhami* Sm. Trenton, Aug. 2, (Evans). An unexpected locality; all the specimens heretofore seen are from Winnipeg, (J.B.S.).
3,066. *Bomolocha bijugalis* Wlk. Cartwright, July 4; recorded previously from Winnipeg by Hanham, first I have taken, (Heath).
3,087. *Gnophæla latipennis* Bdv. Similkameen, B.C., July 22 and 24, (Sherman and Harvey).
3,317. *Eupithecia nevadata* Pack. Duncans, April, (Day).
Eupithecia quebecata Taylor MS. Digby, N.S., Sept. 19, (Russell); Rostrevor, Ont., Sept. 16, (Gibson). First Ontario record.
Eucymatoge togata Hbn. Digby, July 22, (Russell). Mr. Taylor says: "This is a specimen of the European *E. togata*, which I have placed on the American list. I have taken the species at Wellington, B.C. This Nova Scotian specimen is more typical than mine."
3,392. *Hydriomena speciosata* Pack. Departure Bay, B.C., Aug. 10, (Young).
Hydriomena manzanita Taylor. Goldstream, B.C., April 19, 1,000 feet, (Harvey).
Xanthorhœ fossaria Taylor. Victoria, May and June, (Harvey).

3,708. *Cymatophora wauaria* L. Mt. St. Hilaire, Que., June 30, (Chagnon).
3,747. *Sympherta tripunctaria* Pack. Departure Bay, Aug. 25, (Young).
3,799. *Alcis latifasciaria* Pack. Departure Bay, Aug. 22-28, (Young).
3,802. *Alcis latipennis* Hulst. Departure Bay, Aug. 3, (Young).
3,878. *Jubarella danbyi* Hulst. Duncans, April, (Day).
3,922. *Ennomos subsignarius* Hbn. As mentioned in the Ottawa Naturalist, Sept., 1908, enormous numbers of these moths visited Ottawa on July 23. Thousands appeared in all parts of the city.
4,040. *Leucobrephos brephoides* Wlk. Hymers, April 9, (Dawson). This is the first record we have for Ontario.
4,216. *Sesia pictipes* G. & R. Levis, Que., (Fyles).
4,221. *Sesia acerni* Clem. Ottawa, July 8, at light, (Fletcher).
4,496. *Nymphula obliteralis* Wlk. Larvæ found at Ottawa feeding on *Lemna trisula*, (Fletcher).
4,569. *Crambus bidens* Zeller. Aweme, Aug. 9, (Criddle); Mer Bleue, near Ottawa, July, (Young).
4,571. *Crambus trichusalis* Hulst. High River, (Baird); Regina, (Willing); Redvers, Sask., (A. J. Crocker).
4,608. *Crambus zeellus* Fern. Ottawa, July 15, (Gibson).
Crambus cockleellus Kearf. Kaslo, Aug. 10, 11, (Cockle).
Crambus dorsipunctellus Kearf. Rounthwaite, Man., July, (Marmont).
Crambus youngellus Kearf. Mer Bleue, near Ottawa, July 2-10, (Young).
Thaumatopsis gibsonella Kearf. Rostrevor, Ont., Sept. 2-16, (Gibson).
Eucosma annetteana Kearf. Cartwright, May 23, (Heath).
Eucosma medioviridana Kearf. Ottawa, Aug. 17-21, (Young).
5,239. *Ancylis mediofasciana* Clem. Cartwright, May 23, (Heath).
Enarmonia multilineana Kearf. Aweme, June 26, 29, (Criddle).
Gelechia terminimaculella Kearf. Aweme, June 13-16, (Criddle); Rounthwaite, June 15, (Marmont).
Gelechia alternatella Kearf. Aweme, May 12-25, (Criddle).
Coleophora elæagnisella Kearf. Ottawa. Larvæ abundant on *Elæagnus argentea*, moths emerged July, (Fletcher and Gibson).
6,257. *Lithocolletis lucidicostella* Clem. Ottawa, June 11, (Young).
6,301. *Lithocolletis basistrigella* Clem. Ottawa, bred from oak, March 11, (Young).
6,305. *Lithocolletis aceriella* Clem. Ottawa, June 16, (Young).
6,310. *Lithocolletis tilieacella* Chamb. Ottawa, July 17, (Young).
Lithocolletis fletcherella, Braun. Ottawa, bred from Oak, (Fletcher and Gibson).
Argyresthia laricella Kearf. Mer Bleue, near Ottawa, reared from terminal twigs of *Larix americana*, moths issued Ottawa, June 12-23, (Fletcher and Gibson).
6,608. *Hepialus hyperboreus* Moesch. Hymers, Ont., Aug. 23, (Dawson).
6,610. *Hepialus gracilis* Grt. Levis, (Fyles).

Coleoptera.

(Arranged according to Henshaw's List of the Coleoptera of America, North of Mexico).

18*c*. *Cicindela montana* Lec. Lethbridge, Alta., (Harms).
25*a*. *Cicindela audubonii* Lec. Lethbridge, April, (Harms).

25*d*. *Cicindela 10-notata* Say. Lethbridge, April, (Harms).
28. *Cicindela fulgida* Say. Westbourne, Man., Aug. 14, (Wallis). New to Manitoba.
32. *Cicindela vulgaris* Say. Lethbridge, (Harms).
33*c*. *Cicindela 12-guttata* Dej. Lethbridge, (Harms).
34. *Cicindela pusilla* Say. Westbourne, Aug. 14, seven specimens, showing great range of maculation from almost immaculate to very bright and evenly marked, (Wallis).
35. *Cicindela hirticollis* Say. Lachute, Que., Aug. 3, (Criddle and Fletcher).
119*c*. *Carabus oregonensis* Lec. Westbourne, Aug. 19, (Wallis).
148*b*. *Calosoma zimmermanni* Lec. Lethbridge, (Harms).
208. *Promecognathus lævissimus* Dej. Goldstream, B.C., 1,110 feet, July 4, (Harvey).
Amara thoracica Hayward. Mr. Evans has sent in the following record: 1 specimen collected by John Macoun in the N. W. T., in 1880.
990. *Zacotus matthewsii* Lec. Victoria, B.C., Feb. 20, (Harvey).
1,081. *Harpalus amputatus* Say. Vernon, Aug. 18, (Harvey). New to British Columbia.
1,102. *Harpalus innocuus* Lec. Vancouver, May 1, (Harvey).
1,404. *Matus bicarinatus* Say. St. Lambert, Que., Aug., (Chagnon).
1,465. *Rhantus notatus* Fab. Winnipeg, Sept. 11, (Wallis).
1,467. *Rhantus tostus* Lec. Winnipeg, July 24, Aug. 8, (Wallis).
1,482. *Dytiscus hybridus* Aubé. Winnipeg, May 24, (Wallis).
1,483. *Dytiscus verticalis* Say. Mahone Bay, N.S., May 20, (Miss Blanche Colp). Record sent by Dr. C. A. Hamilton, of Mahone Bay.
1,485. *Dytiscus sublimbatus* Lec. Winnipeg, May 8, (Wallis).
1,486. *Dytiscus marginalis* L. Winnipeg, May 8, (Wallis).
1,499. *Graphoderes cinereus* L. Winnipeg, July 4, (Wallis).
1,585. *Hydrophilus ovatus*, G. & H. Ottawa, at light, May 12, (Fletcher).
1,629. *Philhydrus bifidus* Lec. Winnipeg, Aug. 20, (Wallis).
2,627. *Tachinus crotchii* Horn. Vancouver, March 23, (Harvey).
3,074. *Mysia hornii* Cr. Vernon, (Venables).
3,076. *Anatis rathvoni* Lec. Victoria, April 11, (Harvey).
3,402. *Triphyllus humeralis* Kirby. Found in large numbers, near Montreal, in fungus, early May. Mr. Fall tells me that this belongs to the Malandryidæ and should be transferred to that family, (Chagnon).
Exoma pleuralis Casey. Metlakatla, B.C., (Keen).
4,001. *Helodes apicalis* Lec. Vancouver, April 14, (Harvey).
4,011. *Cyphon brevicollis* Lec. Wellington, April 17, (Harvey).
4,029. *Stethon pectorosus* Lec. Ste. Anne de Bellevue, Que., several found by Mr. Swain and me, in July, under bark of fallen tree, (Chagnon).
4,068. *Sarpedon scabrosus* Bonv. Vancouver, (Harvey). New record for British Columbia. Two specimens of this rare beetle were taken many years ago at Ottawa, (Harrington and Fletcher).
4,105. *Cardiophorus fenestratus* Lec. Vancouver, April 28; Victoria, July 8, (Harvey).
4,440. *Corymbites protractus* Lec. Vancouver, April 28, (Harvey). New to British Columbia.
4,450. *Corymbites tarsalus* Melsh. Vancouver, April 27, (Harvey). New record.

4,506. *Asaphes oregonus* Lec. Goldstream, July 4, (Harvey).
4,568. *Chalcophora angulicollis* Lec. Near Princetown, B.C., July 23, (Harvey).
5,467. *Aegiolia cylindrica* Esch. Vancouver, April 14, (Harvey).
5,528. *Aphodius granarius* L. Vancouver, May 9, (Harvey). New record.
5,923. *Cremastochilus pilosicollis* Horn. Vernon, in ants' nests in early spring, (Venables).
6,174. *Calloides nobilis* Say. Wakefield, Que., on oak, July 7, (Gibson).
6,223. *Desmocerus cribripennis* Horn. Hope Mts., B.C., July 17, (Sherman).
6,246. *Toxotus obtusus* Lec. Vernon, (Venables).
6,323. *Leptura instabilis* Hald. Vernon, on lupin, June, (Venables).
6,323*a*. *Leptura convexa* Lec. Vernon, on lupin, June, (Venables).
6,340. *Leptura quadrillum* Lec. Grouse Mt., Vancouver, B.C., July 9, (Sherman).
6,556. *Zeugophora consanguinea* Cr. Vernon, (Venables).
Acanthocinus ædilis S. A specimen of this fine European beetle was found at Ottawa among some packing in a box of chinaware received from Germany, (R. B. Whyte).
6,560. *Syneta simplex* Lec. Vancouver, Aug. 2, (Harvey). New record for British Columbia.
6,968. *Haltica evicta* Lec. Nicolum R., B.C., July 13, (Harvey).
6,988. *Epitrix subcrinita* Lec. Vernon, (Venables).
7,396. *Cœlocnemis dilaticollis* Mann. Penticton, B.C., (Mrs. Fowler). Record sent by Mr. Wallis.
7,721. *Rhinosimus æneirostris* Mann. Vancouver, April 14, (Harvey).
7,724. *Calopus angustus* Lec. Duncans, in a spider's web, March 15, (Hanham).
8,158. *Cantharis sphæricollis* Say. Princetown, B.C., July 22, (Harvey).
8,438. *Lepyrus geminatus* Say. Hope Mts., July 21, (Harvey).
8,543. *Erycus puncticollis* Lec. Under rotten logs on shore of Long Lake, March 31; on leaves of wild raspberry, same place, May 24, (Venables).
9,942. *Hister umbrosus* Casey. Vernon, under carrion, (Venables).
9,944. *Hister electus* Casey. Wellington, July 2, (Harvey). New record.
11,073. *Cryptorhynchus lapathi* L. Durndurn, Sask., in Carolina poplar, end May, (Dr. W. A. Wilson).

Diptera.

(Arranged according to a Catalogue of North American Diptera, by J. M. Aldrich, Smithsonian Misc. Coll. XLVI., No. 1,144. The numbers refer to the pages of the catalogue.)

92. *Eriocera longicornis* Walk. Mamamattawa River, Hudson Bay Slope, June 21; Little Current River, Hudson Bay Slope, July 8; Nagagami River, Hudson Bay Slope, June 20, (Wilson).
Anopheles occidentalis D. & K. Negagami R. 7th portage, June 7, (W. J. Wilson).
131. *Aedes sylvestris* Theob. Ottawa, June 20, 1901; June 18, 19, 1906, (Fletcher).
Aedes riparius, D. & K. Winnipeg, (F. Knab); Ottawa, June 11, (Fletcher).
Aedes campestris D. & K. Regina, June 14, 15; Carnduff, May 28; Qu'Appelle, June 9, (Willing).

131. *Culex restuans* Theob. Ottawa, Aug., Sept., (Fletcher).
133. *Tæniorhynchus perturbans* Wlk. Ottawa, June 20, July 1, (Fletcher).
167. *Dilophus breviceps* Loew. Mamamattawa River, June 21, (Wilson).
169. *Simulium bracteatum* Coq. Vancouver, April 24, (Harvey).
196. *Chrysops discalis* Will. Maple Creek, Sask., June 12, (Willing).
Chrysops lupus Whitney. Youghall, N.B., July 27, (Fletcher).This is of interest as it had not been taken so far east before, (J. S. H.).
202. *Tabanus carolinensis* Macq. Ottawa, May 20, (Fletcher).
203. *Tabanus epistates* O.S. Meach Lake, Que., near Ottawa, June 18, (Fletcher).
204. *Tabanus illotus* O.S. Megiskon River, Ont., July, (Wilson).
204. *Tabanus insuetus* O.S. Prince Albert, Sask., July 27, (Fletcher).
Tabanus osburni Hine. Banff, Aug. 2, (Fletcher).
206. *Tabanus punctifer* O.S. Vernon, July 11, (Venables).
207. *Tabanus septentrionalis* Loew. St. Albert, Alta., July 20, (Fletcher).
217. *Atherix variegata* Walk. Mamamattawa River, June 21, (Wilson).
Cophura albosetosa Hine. Hope Mts., B.C., July 19; Similkameen, July 20, (Harvey and Sherman).
Anthrax harveyi Hine. Hope Mts., July 20-23, (Sherman and Harvey).
236. *Bombylius lancifer* O.S. Bowen Island, Vancouver, B.C., May 24, reported by R. V. Harvey. First record for Canada, (J.S.H.).
236. *Bombylius metopium* O.S. Hope Mts., July, (Harvey). First record for Canada, (J.S.H.).
281. *Machimus avidus* Van der Wulp. Victoria, July 22, (Harvey). First record for Canada, (J.S.H.).
282. *Asilus angustifrons* Will. Goldstream, Vancouver Island, Aug, 20, (Harvey). First record for Canada, (J.S.H.).
347. *Chrysotoxum derivatum* Walk. Hope Mts., July 20, (Sherman).
348. *Chrysotoxum ypsilon* Will. Banff, Alta., one specimen, (Sanson). I recently recorded the first record for Canada from a specimen taken at Kaslo, B.C., in 1903, by Dr. Dyar. This Banff record is the first east of the Great Divide, and bears testimony to what I have written once or twice, that the various species of insects find distribution over the Divide much easier in Canada than in the Rockies further South. (R.C.O.).
361. *Melanostoma kelloggi* Snow. Mer Bleue, near Ottawa, June 19, (Fletcher).
Xanthogramma tenuis Osburn. Ottawa, Sept., (Fletcher). This is an exceptionally good find, (R.C.O.). The species was described in Can. Ent., Jan., '08, from a specimen taken in the Hope Mts., by Mr. R. V. Harvey.
367. *Syrphus pauxillus* Will. Gabriola Island, B.C., June 6, (B. R. Elliott).
Syrphus insolitus Osburn. Victoria, one pair, April 18, (Harvey).
385. *Eristalis compactus* Walk Banff, one specimen, (Sanson). Only one previous record for Canada, at Martin Falls, the type, (R.C.O.).
387. *Eristalis occidentalis* Will. Regina, June 18, (Willing). Much farther east than ever before recorded. I have specimens from Banff, the farthest eastern record previously, (R.C.O.).

389. *Eristalis transversus* Weid. Little Current River, July 16, (Wilson).

400. *Chrysochlamys crœsus* O.S. Victoria, B.C., July 1, one specimen, (Hanham); Goldstream, B.C., July 4, (Harvey). I recently published the first record for Canada based on a specimen taken by Harvey at Victoria, 8, VI., '06, (R.C.O.).

Specomyia occidentalis Osburn. Gabriola Island, June 6, (B. R. Elliott).

572. *Helomyza limbata* Thom. Grouse Mt., July 9, (Sherman). First record for Canada, (J.S.H.).

Hymenoptera.

In last year's Record mention was made of some Bombi which had been determined by Mr. H. J. Franklin. During the past year further collections of these insects have been examined by Mr. Franklin, and from a complete list of the species named by him, the following are thought worthy of mentioning here. Unfortunately, little work seems to have been done in the important order of hymenoptera in Canada during the year, consequently very few other records have been received.

Bombus praticolus Kirby. St. Albert, Alta., (Fletcher); Metlakatla, B.C., (Keen).

Bombus mixtus Cress. Metalakatla, (Keen); Mt. Cheam, B.C., (Fletcher); Banff, Alta., (Sanson).

Bombus appositus Cress. Kelowna, B.C., (Fletcher).

Bombus edwardsii Cress. Mt. Arrowsmith, B.C., Duncans, B.C., (Fletcher); Banff, (Sanson).

Bombus kirbyellus Curtis. Bartlett Bay, Alaska, at sea level, (Nelles). One of the rarer species (H.J.F.).

Bombus borealis Kirby. Beaver Lake, Alta., (Halkett). Not a very common species, (H.J.F.).

Bombus sitkensis Nylander. Mt. Cheam, (Fletcher); Skagway District of Northern British Columbia, (G. White-Fraser).

Bombus californicus Smith. Olds, Alta., (Willing); Duncans, (Fletcher). Not very common in western Canada; not present in eastern Canada, (H.J.F.).

Bombus nigroscutatus Franklin MS. Skagway District of Northern British Columbia, (G. White-Fraser). Apparently rare in Western Canada; not present in eastern Canada, (H.J.F.).

Bombus terrestris, var. *moderatus* Cress. Banff, (Sanson). Rare in Western Canada; not present in the east, (H.J.F.).

Bombus couperi Cress. Nepigon, (Fletcher); Anticosti, (Dr. Jos. Schmitt). One of the rarer species, (H.J.F.).

Bombus rufocinctus Cress. Ottawa, Sept. 20, (Fletcher); Radisson, Sask., (Fletcher). This species is rare in eastern Canada, and extremely variable in colouration, (H.J.F.).

Bombus vagans Smith. Rostrevor, Muskoka, Ont., Sept., (Gibson); Regina, Sask., Banff, (Fletcher); Westbourne, Man., Aug. 26, (Wallis).

Bombus virginicus Oliv. Mer Bleue, near Ottawa, June 6, (Gibson).

Psithyrus consultus, Franklin, MS. Nelson, B.C., Mt. Cheam, Regina, (Fletcher).

Psithyrus suckleyi, Greene. Duncans, Banff; Mt. Arrowsmith, (Fletcher).

Prosopis basalis, Smith. Winnipeg, June 10, (Wallis).

Pompilus terminatus, Say. Penticton, B. C., Aug., (Miss B. Farmer).
Ichneumon feralis, Cress. Winnipeg, Aug. 23, (Wallis).
Ichneumon caliginosus, Cress. Westbourne, Man., Aug, 24, (Wallis).
Ichneumon acerbus, Cress. Treesbank, Man., April 17, (Wallis).
Rhyssa persuasoria, L. Hymers, Ont., Sept. 6, (Dawson).
Ephialtes gigas, Walsh. Hull, Que., June 13, (Gibson).
Thyreodon morio, Fab. Stonewall, Man., July, (Wallis).
Macrophya oregona, Cress. Hope Mts., July 17, (Harvey).
Tenthredo melanosoma, Hartg. Hope Mts., July 17, (Harvey).

Hemiptera.

Several collectors have, during the year, given special attention to the hemiptera. Most of the species mentioned below were identified by Mr. E. P. Van Duzee. The Ottawa species, probably none of which are very rare, are included as they are the only records we have for the district.

Telamona reclivata, Fitch. Ottawa, July 14, (Metcalfe); Sept. 2, on basswood, (Groh).

Telamona ampelopsides, Harr. Ottawa, July 14, (Gibson).

Cyrtolobus vau, Say. Ottawa, June 29, on red oak, (Fletcher).

Cyrtolobus griseus Van D. Ottawa, on oak, Aug. 25, (Metcalfe).

Scolops sulcipes, Say. Ottawa, Sept. 5, on Goldenrod, (Groh).

Liburnia foveata, Van D. Mer Bleue, near Ottawa, June-Sept., (Metcalfe).

Aphrophora signoretii, Fitch. Regina. Sask., Aug. 8, (Fletcher).

Bythoscopus pruni, Prov. Ottawa, June 21, (Gibson).

Gypona flavilineata, Fitch. Ottawa, Sept. 7, (Gibson).

Gypona scarlatina, Fitch. Wakefield, Que., July 7, (Gibson).

Gypona albosignata, Uhl. Trenton, Ont., Sept. 1, (Evans).

Deltocephalus abdominalis, Fab. Near 60 Mile River, along 141 Meridian, Yukon Territory, (P. Reilly).

Phlepsius irroratus, Say. Ottawa, Oct. 8, (Fletcher).

Athysanus extrusus, Van D. N.W.T., 1881, (John Macoun); record sent by J. D. Evans.

Dorycephalus platyrhynchus, Osborn. Aweme, Man., July 13, (Fletcher).

Typhlocyba bifasciata, G. & B., Ottawa, June 22, (Gibson).

Cicadula 6-notata, Fall. Ottawa, on aster, Aug. 31, (Fletcher).

Thyreocoris unicolor, P. B. Aylmer, Que., in pappus of *Sonchus arvensis*, Aug. 29, (Groh).

Eurygaster carinatus, Van D. Vernon, B. C., June 6, (Venables).

Carpocoris remotus, Harvath. Vernon, Aug. 12, (Venables).

Brochymena affinis, Van D. Peachland, B. C., June 27, (Wallis).

Leptoglossus occidentalis, Heidemann MS. Vernon, B.C., Sept. 27, (Venables).

Nysius scolopax, Say. Vernon, (Venables).

Geocoris decoratus, var. *solutus* Mantodon. Ottawa, June 4, (Fletcher).

Geocoris limbatus, Stal. Mer Bleue, near Ottawa, uncommon, (Metcalfe).

Geocoris uliginosus, var. *limbatus*, Stal. Vernon, Sept. 4, (Venables).

Lygus monachus, Uhl. Ottawa, on basswood, July 1, (Metcalfe).

Lygus tenellus, Uhl. MS. Ottawa, on basswood, June 25, (Gibson).

Lygus invitus, Say. Ottawa, on basswood, June, (Metcalfe).

Calocoris bipunctatus, Fab. Annapolis Royal, N.S., (V. A. Eaton).

Neoborus pettiti, Uhl. MS., Ottawa, on white ash, Aug., (Metcalfe).
Neoborus saxeus, Dist. Ottawa, on white ash, Aug., (Metcalfe).
Plagiognathus obscurus, Uhler, Aylmer, Que., near Ottawa, Aug. 29, (Groh).
Triphleps tristicolor, White. Ottawa, Dec. 6, (Fletcher).
Gerris sulcatus, Uhl. Beaver Meadow, Hull, Que., May; Toronto, April, (Metcalfe).
Gerris rufoscutellatus, Latr. Ottawa, May; Toronto, April 1, (Metcalfe).
Acanthia ligata, Say. Little Current River, Hudson Bay Slope, July 11, (Wilson).
Corythuca marmorata, Uhl. Ottawa, rare, June, (Metcalfe).
Microvelia americana, Uhl. Beaver Meadow, Hull, May, (Metcalfe).
Acanthia humilis, Say. Ottawa, (Metcalfe).
Acanthia confluens, Say. Ottawa, (Metcalfe).
Acanthia reperta, Uhl. Ottawa, (Metcalfe).
Acanthia signoretii, Guer. Ottawa, (Metcalfe).
Ranatra quadridentata, Stal. Pickerel point on Ottawa River, near Ottawa, July, (Metcalfe).
Ranatra kirkadyi, Bueno. Ottawa, (Metcalfe).
Hydrometra martini, Kirby. Ottawa River, Pickerel Point, July, (Metcalfe).

ORTHOPTERA.

During the year some good work has been done in this important order. Dr. E. M. Walker writes: "I have examined some 800 specimens from the Prairie Provinces and British Columbia, collected chiefly by Messrs. T. N. Willing and N. Criddle, Prof. W. J. Alexander and the late Dr. Fletcher. These will form the basis of a paper which I have about completed. Besides this material I have yet to report on collections made at Go Home, Georgian Bay, the Temagami region, Fort William and Nepigon, Ont."

The following records have been sent in by Dr. Walker as worthy of being included here:—

Nomotettix cristatus (Scudd.). Go Home, Georgian Bay, June-July, 1907, (Walker).
Tettix acadicus, Scudd. Temagami, Sept, 1908; Fort William, Aug. 1907, 1 female (Walker); Aweme, Man., May-June, 4 males, 5 females (Criddle).
Tettix brunneri, Bol., Temagami, Sept., 1908, 1 male, long-winged, (Walker).
Platybothrus brunneus, (Thom.). Regina, Sask., June 5, 1903, 1 male, (Willing).
Encoptolophus parvus, Scudd. Aweme, Sept. 6, 1907, 1 male, (Criddle); Walsh, Sask., Aug. 23, 1901, 4 males, 12 females; Regina, Sept. 19, 1903, 1 female, (Willing).
Hippiscus neglectus, (Thom.). Aweme, July 14, 1904, 2 females, (Criddle).
Circotettix undulatus, (Thom.). Cowley, Sask., July 29, 1901, 1 female; Medicine Hat, Oct. 1, 1903, 1 female, (Willing).
Circotettix carlinianus, (Thom.). Maple Creek, Sask., Aug. 2, 1902, 1 female, (Willing).
Melanoplus angustipennis, (Dodge.). Aweme, Aug. 18, 1906, 1 male, (Criddle).

Melanoplus angustipennis coccineipes, Scudd. Aweme, July, Aug., Oct., 1904-07, 4 males, 1 female, (Criddle).

Melanoplus foedus, Scudd. Swift Current, Sask., Aug. 5, 1901, (Willing).

Phoetaliotes nebrascensis, (Thom.). Walsh, Sask., Aug. 23, 1901, 1 short-winged female, teneral, (Willing).

Oecanthus quadripunctatus, Beut. Aweme, Aug-Sept., 1904, 2 males, 2 females, (Criddle).

Odonata.

Some interesting collections of these insects have been made in 1908, and much material collected in previous years, has been gone over and carefully identified. Dr. E. M. Walker has been most helpful in naming material, and we are all very grateful to him for his continued kindnesses. Dr. Walker says: "In the Odonata, about 400 specimens from the Prairie Provinces have been examined. These were taken by Messrs. Willing, Criddle, Alexander, Fletcher, and Wallis. A list of these will give a fair idea of the Odonata fauna of this region, which is at present a *terra incognita* in this order. A considerable number of species was also collected by Mr. A. G. Huntsman, of the Biological Department, University of Toronto, at the new marine Biological Station on Vancouver Island, B.C. A good deal of material from the East has also been gone over. It comprises collections from the vicinity of Sault Ste. Marie, belonging to Mr. E. B. Williamson, of Bluffton, Ind., from Georgian Bay, Fort William, Nepigon and Temagami, made by the writer, and from Youghall, New Brunswick, by Mr. Arthur Gibson."

Dr. Walker has provided the following records:—

Lestes congener, Hagen. Aweme, Man., Aug. 29, 1907, 1 male, (Criddle); Westbourne, Man., July-Aug., 5 males, 6 females, (Wallis).

Nehalennia irene, Hagen. Westbourne, Man., July 27-29, 1908, 1 male, 2 females; Winnipeg, July 7, 1908, 1 male, 1 female, (Wallis).

Agrion lunulatum, Evans. Aweme, July 4, 1905, 1 male, (Criddle); Winnipeg, July 6, 1908, 1 male, (Wallis); Carnduff, June 18, 1905, 1 male; Regina, 2 males, 1 female, (Willing). This is the first time this Old World species has been reported from North America. I had thought it a new species, but Mr. K. J. Morton, of Edinburgh, Scotland, who has specimens from Redvers, Sask., pointed out to me its true relationship. The Canadian specimens differ slightly from European ones with which they have been compared and may be distinct, but more material will be necessary to determine the point (E. M. W.).

Agrion resolutum, Hagen. Youghall, N.B., July 20, 1908, 1 male, (Gibson); Little Carp River, Algoma, Ont., June 29, July 6, 1907, 5 males, 2 females, (Donaldson); Winnipeg, Man., July 7, 1908, 1 male, (Wallis).

Enallagma civile, Hagen. Winnipeg, July 9, 24, 1 male, 1 female, (Wallis).

Aeshna sitchensis, Hagen. Westbourne, Aug. 19, 1 male, (Wallis).

Aeshna constricta, Say. Westbourne, July 29, Aug. 26, 1 male, 3 females. This is the extreme northwestern limit of this species' range, so far as known, (E. M. W.).

Somatochlora forcipata, Scudd. Silver Creek Falls, Algoma, July 9, 1907, 1 male, (Donaldson).

Cordulia shurtleffi, Scudd. Silver Creek Falls, July 9, 1907, 1 male, (Donaldson); Youghall, N.B., July 18, 1 male, (Gibson).

Leucorhinia borealis, Hagen. Aweme, July 15, 1907, 1 female, somewhat teneral, (Criddle). This species is but little known and is represented in very few collections. The determination was verified by Dr. Calvert, (E. M. W.).

NEUROPTEROID INSECTS. (EXCEPT ODONATA.)

During the year some small collections of neuropteroid insects have been submitted to specialists. The names of some of the species have been received; others have not yet been reported upon. The species mentioned as having been collected by Mr. W. J. Wilson, of the Geological Survey, Ottawa, were taken in the Hudson Bay Slope, and, through the courtesy of Dr. L. O. Howard, have been recently identified by Dr. Nathan Banks, who also examined Mr. Wallis' specimens. The numbers below refer to the pages in Dr. Banks' catalogue published in 1907 by the American Entomological Society.

ARCHIPTERA.

10. *Pteronarcys regalis* Newm. Winnipeg, June 1, (Wallis).

11. *Isogenus frontalis*, Newm. Kabina Kagami River, Aug. 1, (Wilson).

13. *Isoperla bilineata*, Say. Little Current River, July 16, (Wilson).

13. *Isoperla ebria* Hag. Treesbank, Man., June, (E. Ellis).

14. *Nemoura perfecta*, Walk. Little Current River, July 20, (Wilson).

15. *Capnia vernalis*, Newp. Mamamattawa River, June 21, (Wilson).

NEUROPTERA.

21. *Chauliodes californicus*, Walk. Kaslo, B.C., July 27, (Cockle).

22. *Sialis infumata*, Newm. Little Current River, July 16, (Wilson); Norman, Ont., July 19, (Wallis).

33. *Panorpa rufescens* Ramb. Winnipeg, July 1, (Wallis).

34. *Boreus californicus*, Pack. Kaslo, on snow, (Cockle), Banff, (Sanson).

TRICOPTERA.

35. *Phryganea improba*, Walk. Westbourne, Man., Aug. 5, (Wallis).

36. *Glyphotælius hostilus*, Hag. Kabina Kagami River, Aug. 1, (Wilson).

36. *Limnephilus indivisus*, Walk. Westbourne, Aug. 17, (Wallis).

36. *Limnephilus extractus*, Walk. Westbourne, Aug. 20, (Wallis).

Limnephilus moestus, Banks. Westbourne, Aug. 20, (Wallis).

37. *Limnephilus ornatus*, Banks. Winnipeg, June 19, (Wallis).

37. *Anabolia bimaculata*, Walk. Westbourne, Aug. 1, (Wallis).

37. *Colpotaulius medialis*, Banks. Westbourne, Aug. 20, (Wallis).

37. *Colpotaulius perpusillus*, Walk. Westbourne, Aug. 20, (Wallis).

38 *Pycnopsyche similis*, Banks. Kabina Kagami R., Aug. 11, (Wilson).

42 *Brachycentrus fuliginosus*, Walk. Nagagami R., Station 52, June 23, (Wilson).

45. *Leptocerus resurgens* Walk. Westbourne, Aug. 1, (Wallis).

46. *Œcetina avara* Banks. Westbourne, July 28, (Wallis).

47 *Hydropsyche cockerelli*, Banks. Nagagami R., June 6, (Wilson).

Araneida.

Among some insects brought back from the Hudson Bay Slope in 1903 by Mr. W. J. Wilson, of the Geological Survey, Ottawa, was a small collection of spiders. These have recently been kindly named by Dr. Banks, through Dr. Howard. Owing to the northern locality at which the specimens were collected the list is given in full.

Epeira silvatica, Em. Kabina Kagami River, Aug. 11.
Epeira patagiata, Clerck. Mamamattawa River, June 21.
Gnaphosa conspersa, Th. Nagagami River, June 15.
Amaurobius bennetti, Blk. Nagagami R., June 6.
Tetragnatha extensa, L. Little Current River, July 16.
Lycosa pratensis, Emer. Kabina Kagami River, Aug. 11.
Lycosa kochi, Keys. Kenogami River, July 2.
Agrœca pratensis, Emer. Kabina Kagami River, Aug. 9.
Agalena nævia, Htz. Little Current River, July 17.

INSECTS OF THE YEAR 1908 AT OTTAWA.

By Arthur Gibson, Central Experimental Farm, Ottawa.

The season of 1908, at Ottawa, has been a remarkable one, owing to the long continued drought. The months of June, July, August and September were particularly dry, the rain fall from the end of May till the beginning of October being only 6.80 inches. Vegetation consequently suffered very severely, but insects were more plentiful than usual and some serious outbreaks occurred.

Early in the season Cankerworm larvæ were abundant, their attacks being specially noticed on basswood, beech and birch. These insects seem to be on the increase again. The injury ceased about the 15th June, after which date very few caterpillars were noticed.

The American Tent Caterpillar, *Malacosma americana*, Fab., is also on the increase. On May 16th the work of the young caterpillars was very conspicuous on many trees near the city. On May 30th a large number of the nests were noticed at Chelsea, Que., about 7 miles from Ottawa. At that date some small wild cherry trees were almost stripped of their foliage.

On the same date at Chelsea, I found a nest of caterpillars of *Archips fervidana* on red oak. The nest was rather conspicuous, being several leaves drawn together somewhat in the shape of a ball. The caterpillars were all inside. This insect is better known in the United States where it has been recorded as destructive to several kinds of oak. In the Ottawa district it has never appeared commonly. When mature the caterpillar is nearly an inch long, of a yellowish-green colour, with the head and thoracic shield black. Moths from the above larvæ emerged on July 20th.

The Turnip Flea Beetle, *Phyllotreta vittata*, Fab. This small, very active, shining, black beetle was very troublesome in many gardens. The beetles did much harm to young turnips and were also very destructive to the first sowing of radishes. Where Paris green and land plaster, or Paris green and flour, were dusted on the plants, one pound of the former to 20 of the latter, the injury was soon stopped.

Root Maggots were more abundant than in 1907. The flies of the Radish Maggot were noticed flying around the young plants on May 16th. About the middle of June many plants examined were seen to be infested.

Unfortunately there is nothing new in the way of a remedy, that we know of, for these very destructive insects. For radishes preparations con-

taining carbolic acid, applied once a week after the plants appear above ground, until they are ready for the table, have given about the best results.

The Hessian Fly, *Mayetiola destructor*, Say., was present, in the district, in destructive numbers in spring wheat. Plants were noticed to be infested about the end of May, and in some places the attack was quite serious. On the Central Experimental Farm, in fields where the soil was poor and where the unfavourable weather conditions had weakened the plants, probably as many as 50% were infested by the Hessian Fly. In other fields where the soil was better, the plants were stronger and better able to withstand the unfavourable conditions of the season, and in these fields the loss from Hessian Fly would amount to about 5%. From collected material, both sexes of the flies emerged in the Division on June 20th, 22nd and 23rd.

For some years we have noticed at Ottawa, that the young leaves of spinach were fastened together at the tips of the shoots by a small lepidopterous larva. This year we made some observations on the insect and were successful in rearing the moths, specimens emerging on July 18th. It is one of the micros and we hope soon to have its determination. During the present year the insect was particularly abundant, and in my own garden, and one or two others which I visited, it practically rendered every plant unfit for use.

Sparganothis flavibasana, Fern. This interesting and rare tortrix was again destructive to the Caprifolium group of Loniceras in the Arboretum and Botanic Garden of the Central Experimental Farm. The larvæ were quite numerous on some of the bushes. In 1907, however, they were in much greater numbers and did very noticeable damage. The caterpillar draws together the upper pair of leaves, fastening the same along the edges, so that the newly formed berries and itself are within this tent-like structure. Their presence on a bush is thus easily detected. The injury is done chiefly to the cluster of young berries, or immature fruit, which is eaten, and among which the caterpillar makes a web of whitish silk. In 1907, the larvæ were plentiful on June 19th, and many specimens were collected by Mr. Kearfott and me, from which moths were reared on July 2nd to July 6th. This year larvæ were collected on June 6th, from which we got moths on June 27, 29, 30 and July 9. Pupæ were also found where the larvæ had been feeding. When mature the caterpillar is 15 mm. long when at rest, 17 mm. long when extended. It is cylindrical in shape, bright apple green in colour, and the segments are wrinkled. Dorsal vessel distinct. No markings on the skin. The head is black and shining. The thoracic shield is black, margined in front with white. Tubercles on body are inconspicuous, each bearing a single pale, slender, hair. The feet are all concolorous with the body.

Eriophyes species. The small pocket galls of the genus *Eriophyes* were very noticeable during the past season. The foliage of elm, basswood, maple and wild cherry were particularly disfigured by the work of these mites. Basswood trees were examined on June 12th and were found to be heavily infested by *Eriophyes abnormis*, Garm. Quite a few of the galls were on the under side of the leaves. The leaves of the soft maples, at Ottawa, have been much disfigured of late years by the galls of *Eriophyes quadripes*, Shimer.

At an excursion of the Ottawa Field-Naturalists' Club, held to the Mer Bleue, and nearby vicinity, on June 20, some interesting material was collected. The Mer Bleue is an extensive peat bog, about 12 miles from Ottawa, and is one of the best hunting grounds which we have in the district. The small, curious caterpillars of the plume moth, *Pterophorus eupatorii*, Fern.,

were found in numbers feeding on the leaves of the Joe Pye Weed, *Eupatorium purpureum*, L., and in some pasture fields the Hard Hack, *Spiræa tomentosa*, L., was seen to be badly infested by a cecidomyid. Many of these plants were entirely covered by these galls. Since, the small fly has been reared and specimens have been determined by Dr. E. P. Felt, as *Rhabdophaga salicifolia*, a species which has been found abundant in Massachusettes and New York on the above plant and also on the Common Meadow-sweet, *Spiræa salicifolia*, L. A single worn specimen of the rare butterfly, *Argynnis triclaris*, Hbn., was taken in the Mer Bleue by Mr. Young. On June 9th three fine examples of this insect were captured in the bog, one by Mr. Criddle, one by Mr. Young, and the other by the writer. Dr. Fletcher has, once or twice previously, collected this butterfly at the Mer Bleue, which is probably the most southern locality known for this insect.

The Fall Webworm, *Hyphantria textor*, Harr., was particularly abundant all over the district. Their conspicuous nests were present in large numbers on willow, maple, elm, birch, apple, hawthorn and wild cherry. On July 25th the caterpillars were about half an inch in length and a little over a week later they were nearly an inch long. It is a pity, and a disgrace to every one who has trees, that this insect is allowed to increase to such an extent and render trees so unsightly by the conspicuous nests made by the larvæ. It is a simple matter for hundreds of owners of trees to cut off these nests when they are first noticed, and trample upon the caterpillars under foot.

The Snow-white Eugonia, *Ennomos subsignarius*, Hbn. On the evening of July 23rd last, enormous numbers of these moths appeared in all parts of the city, being attracted to the electric lights. An account of this visitation is given in the *Ottawa Naturalist*, September, 1908. The large numbers of these insects present on that evening caused a good deal of comment. Some of the electric light poles and the sides of buildings were literally covered with the moths and looked as if they had been whitewashed, or given a coat of white paint. The sparrows of the city had a great feast early the following day. Next morning the wings of the insects were to be seen all along the main streets. At the entrance to some of the larger buildings, the wings were so numerous that some little time had actually to be taken to sweep them away. In Dr. E. P. Felt's valuable report for 1907, which has just come to hand, it is stated that the caterpillars of this moth were found in immense numbers defoliating beech trees in Ulster County, New York, during the summer of that year. Possibly they were present in large numbers in other districts. These caterpillars when seen, were mostly mature, and were pupating by July 26th. Moths from these larvæ emerged soon afterwards and eggs were deposited. The insect, therefore, has been steadily increasing for the last two or three years. No caterpillars have been seen in the Ottawa district during the present season, and it would be most interesting to know where all the moths came from. Their sudden great abundance was certainly remarkable. According to the meteorological observations taken at the Central Experimental Farm, by Mr. W. T. Ellis, there were no strong winds at Ottawa during the week beginning July 19th, nor in fact during the week previous to that. The prevailing winds from July 19th to July 25th were south and southwest, but the word "calm" in Mr. Ellis' report signifies that there was practically no wind blowing when the records were taken. During the whole week above mentioned the number of miles recorded is only slightly over 191, while the average of wind for a week is over 900. Of course, the upper currents may have been very much stronger.

The occurrence of the Apple Leaf Hopper, *Empoasca mali*, LeB., in such enormous numbers was undoubtedly the most notable outbreak of the year in Eastern Ontario. At Ottawa injury was done chiefly to potatoes, although beans and other vegetables were severally attacked. The presence of the insects in destructive numbers was noticed towards the end of June, and the injury continued throughout the summer. These insects, which are pale green in colour, slender, about an eighth of an inch in length when mature, feed on the under sides of the leaves by sucking the juices out of the plants. When they are young and before they have developed wings, they can be destroyed by spraying the infested crop with whale oil soap, one pound in five gallons of water, or with the ordinary kerosene emulsion. Some potatoes which were sprayed early in July, before the young leaf hoppers acquired their wings, were freed from the pest, and were not since injured to any appreciable extent. The severity of this outbreak has been much aggravated this season by the exceptional drought and heat, which weakened the plants, and made them more than usually susceptible to injury by the insects.

The Potato Flea-beetle, *Epitrix cucumeris*, Harr., was present in potato fields in the district in considerable numbers. On August 21st it was found to be abundant on potatoes on the Experimental Farm, working with the Apple Leaf Hopper, *Empoasca mali*. This flea-beetle is sometimes, in hot dry seasons, one of the worst enemies of the potato. Dr. Fletcher recommends spraying the vines with Bordeaux mixture, as this treatment has given far better results than spraying with Paris green.

In early August the Destructive Pea Aphis, *Nectarophora pisi*, Kalt., did severe injury to sweet peas in gardens. The plant lice were present in large numbers and from specimens collected later, a number of parasites of the genus *Praon* were reared. The parasitized plant lice were rather numerous on the vines. Field peas near Ottawa were also much attacked by this pest, several complaints of very serious injury being received at the Division.

Other kinds of plant lice were much in evidence during the season. Apple trees were badly infested by the Apple Aphis. Some young trees examined on August 12th were practically covered with the aphides. Some seedlings were sprayed on August 8th with whale oil soap, 1 lb. to 4 gallons of water, and with the ordinary kerosene emulsion, but neither of these mixtures killed all of the insects. The kerosene emulsion did the better work. Vegetable marrows were much reduced in vitality by the attacks of an aphis. Towards the end of the season, Swede turnips, cabbages, and cauliflowers, were attacked by the Turnip and Cabbage Aphis. Early in October, celery plants were severely injured by plant lice, and many rendered useless. The Woolly Aphis of the Apple and the Woolly Aphis of the Alder were also more than usually abundant.

Cutworms, as usual, did much harm in some gardens early in the season. At East Templeton, near Ottawa, they destroyed many tobacco plants. Mr. Letourneau, of our office, who visited the locality early in August, reported to me that cutworms had been much complained of by the farmers of the district. A rather interesting occurrence of the Variegated Cutworm, *Peridroma saucia*, Hbn., was discovered in one of the greenhouses at the Central Experimental Farm, on August 24th. On September 1st, larvæ about ½ an inch long were brought into the Division. In all about 75 larvæ were collected, which had been found feeding on Primulas. No other plants were injured. In confinement they grew rapidly and buried on September 12th, 13th and 14th, the moths emerging in the office on October 20th and 22nd. (Fig. 31).

The caterpillars of the Small White Cabbage Butterfly, *Pontia rapæ*, L., were very troublesome in the Ottawa district during the past season, and many market gardeners complained of their ravages. The remedy of dusting the plants with pyrethrum insect powder, 1 lb. in 4 lbs, of cheap flour, after the whole has been mixed together and kept in a tight jar for 24 hours, is so simple that it is most remarkable that the annual loss by this insect is allowed to take place.

The Codling Moth, *Carpocapsa pomonella*, L., was injuriously present in many orchards in the district. A number of trees near the city were examined on August 12th, and it was estimated that about 25% of the apples on some of the trees were wormy.

The work of the Pear-tree Slug, *Eriocampa cerasi*, Peck., (Fig. 32), which does much harm to pears, cherries and plums, was noticed on plum trees on August 25th. Many of these slimy, greenish-brown, slug-like, larvæ were present on the trees and had done very apparent injury to the foliage. Specimens were found as late as October 5th feeding on the leaves. Spraying with any of the recognized poisonous mixtures, or dusting the trees at short intervals with freshly slaked lime, will destroy the larvæ.

Many householders complained of the ravages of the Clothes Moth. This insect was certainly very abundant in Ottawa during the past summer and did a great deal of damage to furs and woollen goods in houses. The best remedies for these insects are of a preventive nature. All articles liable to attack should be well shaken, brushed, and put away before the moths appear in the spring. As the caterpillars feed only on substances of animal origin, clothing, etc., to be protected may be wrapped tightly in linen, cotton or paper, and left in this way until required for autumn and winter use.

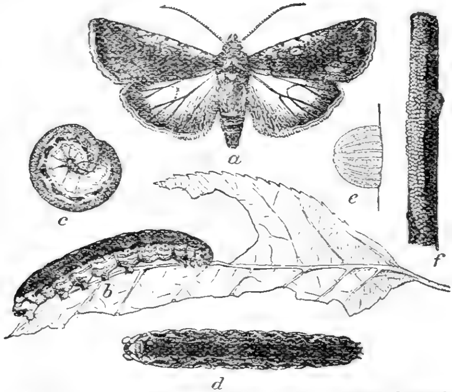

Fig. 31. *Peridroma Saucia; a*, moth; *b*, normal form of larva, lateral view; *c*, same in curved position; *d*, dark form, dorsal view; *e*, egg from side; *f*, egg mass on twig (after Howard, Division of Entomology, U. S. Dept. Agriculture).

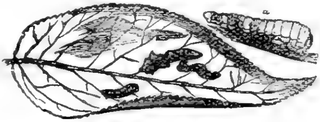

Fig 32. Pear-tree slug.

PRESENT CONDITION OF THE WORK CONNECTED WITH THE IMPORTATION OF THE FOREIGN PARASITES OF THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

By L. O. Howard, Washington, D.C.

In sending this paper to be read before the forthcoming meeting of the Entomological Society of Ontario, the writer assumes that the members of the Society, through the reports by Doctor Fletcher and through the reading of reports published by the Bureau of Entomology of the U. S. Department of Agriculture, as well as from the lecture delivered before the Society last year by Mr. A. H. Kirkland, are informed concerning the progress of this work down to the close of 1907, and what follows is supplementary to that information.

In the autumn of that year the parasite laboratory was moved from Saugus, Mass., to Melrose Highlands, Mass. The new location is much more accessible to Boston and to most of the field colonies of the parasites. The buildings, including several substantial structures built for laboratory purposes by the State of Massachusetts, are much beter fitted for the work. Upon the whole the results of the year's importations have been very promising.

In planning the work several new features have been introduced. The parasites that are constantly being sent over by agents belong to three main groups, namely those of the order Hymenoptera, including the Ichneumon flies, the Chalcis flies and others; those of the order Diptera, including the Tachina flies, and those of the order Coleoptera, including the predaceous ground beetles. The amount of material received has been so great, and the character of the different life histories of the insects involved has been so diverse that it has seemed of great importance to have a thoroughly trained expert, skilled in the biology of each group, placed in charge of each group. This has been done, and an expert has had charge of the Hymenoptera, another of the Diptera, and another of the Coleoptera.

Further, the condition of European sendings by mail and by express during the summer of 1907 was by no means uniformly good. The sendings from eastern Europe which are subject to long railway journeys in addition to the sea voyage, frequently arrived in bad condition. Therefore an innovation was made and a general laboratory depot was established at Rennes, France, under the general supervision of Mr. René Oberthür, and a skilled assistant, Mr. A. Vuillet, was placed in specific charge. Nearly all of the European sendings were shipped to Rennes, were examined, repacked, carried personally by Mr. Vuillet to Cherbourg or to Havre on the known days of sailing of certain steamers, then placed in the hands of the chief stewards of the vessels and carried in the cold room to New York where they were admitted without customs examination and sent direct to Boston. This method has resulted in a much beter average condition of the material received, and has facilitated the rapidity with which the work is being accomplished. The courtesy of the steamship officials is highly appreciated.

The third innovation has been an attempt to secure Japanese parasites of the gipsy moth. It has been known for some years that the true gipsy moth, or one of its varieties, or at least a most closely related species, occurs in Japan, though not in great numbers, and that it is apparently held in check by its parasites. Rev. H. Loomis, an American living in Yokohama, has repeatedly written to the State authorities of Massachusetts and to the

Chief of the Bureau of Entomology conveying this information, and attempts have been made by mail and otherwise to send these parasites to the United States, but without success. Later information received from one of the most skilled economic entomologists of Japan, Mr. Nawa, indicated that there exists in Japan an important egg-parasite of the gipsy moth. Remembering that the Massachusetts gipsy moth came originally from Europe it seemed altogether desirable to introduce first the European parasites, and it seemed probable that these would by themselves reestablish the balance of nature. Then too, the importation of the Japanese species seemed somewhat dangerous, on account of the chance that the Japanese Gipsy moth might prove even more voracious and destructive than the European moth; but, after consideration, it was thought best to leave no stone unturned and to neglect no chances in the search for effective parasites. The European service of collectors and agents and advisers had been well organized and instructed during three annual visits of the Chief of the Bureau to Europe, and it was therefore decided to interrupt the European trip for the present year and to send an agent to Japan. Professor Trevor Kincaid, of the University of Washington at Seattle, was chosen on account of his skill as a collector, his comparative proximity to Japan, and the fact that he is personally acquainted with many persons in Japan. He sailed on the 2nd of March, and the results of the expedition have more than justified the expense involved. A very large amount of parasitic material has been received from him in good condition at Boston, and very many parasites from Japan have been colonized in the woodlands of New England.

Still another decided innovation has been the carrying on of active winter work with parasites, especially those secured from imported nests of the brown-tail moth which began to come in from Europe in December. It was found quite possible to breed these parasites in artificially heated rooms, feeding them upon hibernating native brown-tail moth larvæ brought in in their nests from out of doors, feeding the latter upon lettuce and other hothouse foliage and in the early spring securing more normal food for them by sending it up in boxes by mail from Washington and points south. In this way the breeding of the parasites of the genus Pteromalus was carried forward uninterruptedly throughout the winter, and, as during the breeding of successive generations they multiplied exceedingly, it was possible later in the year to liberate a vastly greater number of individuals than would have been possible had the imported species been allowed to hibernate normally in the nests. In the course of this work Mr. W. F. Fiske, in charge of the breeding operations, has invented a rearing tray which has been of the utmost advantage and which will greatly facilitate parasite rearing work in the future.

Still a fifth innovation and one of great value has been the discovery and practice of retarding the development of brown-tail moth eggs by keeping them in cold storage until the arrival of the European egg-parasites which will oviposit upon and breed in these cold storage eggs as freely as those which they attack in the state of nature. This process it has been ascertained may be carried on for a long time, and successive generations of these egg-parasites may be reared from eggs retarded in their development by cold storage. It is thus easy to breed and to liberate an almost infinitely greater number of these egg-parasites, and under favourable conditions, than would be possible from a simple importation of European parasitized eggs which would have to arrive in America at a specific time. These latter innovations have been due to the ingenuity of Mr. Fiske to whom great praise should be given.

In the same way great advance has been made in the rearing of the Tachinid parasites, under the charge of Mr. C. H. T. Townsend who has devised methods and made observations that have greatly added to our knowledge of the biology of these insects and have resulted in the accumulation of a store of information of the greatest practical value not only in the prosecution of the present undertaking but in any problem of parasitic introduction or control that may arise later. Extraordinary and almost revolutionary discoveries have been made in the life histories of certain of these flies, and without this knowledge the greatest success in handling them practically could not have been reached.

Similarly Mr. A. F. Burgess, in charge of the Coleoptera, has succeeded in a very perfect way in rearing and liberating the important European predatory beetle *Calosoma sycophanta*, as well as some other insects of the same family. Altogether during the fiscal year the following material has been imported:

Brown-tail egg-masses, about 26,000.

Hibernating nests of the brown-tail from 50,000 to 60,000.

Larvæ and pupae of the brown-tail, about 178,000.

Gipsy moth egg-masses, 7 boxes, each containing very many masses.

Gipsy moth larvæ and pupæ, about 161,000.

Gipsy moth larvæ from Japan, 8 large boxes containing several thousand larvæ and parasitic cocoons.

Predatory beetles, 2,892.

It will be noticed that only about half as many of the hibernating nests of the brown-tail were imported during this fiscal year as during last, but the smaller number is offset by the larger numbers of larvæ, pupæ and egg-masses, so that the gross amount received is about the same as that of the previous year. The material received from Japan listed above came in before the 1st July, but in all there have been received about 40 boxes, nearly all of large size. From one shipment of the cocoons between forty-thousand and fifty-thousand adults of one of the most important parasites of the genus Glyptapanteles were reared and were liberated directly in the open.

The colonization work has been going on rapidly during the summer of 1908, and of the species colonized the following have been the most numerous:

Pteromalus from the brown-tail moth nests, 114,000.

Trichogramma from the brown-tail moth eggs, 11,600.

Telenomus from brown-tail eggs, 4,560.

Apanteles of the brown-tail, 12,875.

Japanese Glyptapanteles, 45,000.

Meteorus from brown-tail, 1,080.

Pimpla from brown-tail pupæ, 2,051.

Unclassified Tachinids, 4,177.

Named Tachinids, 1,600.

Calosoma sycophanta, adults and larvæ, 978.

Thus making nearly 200,000 of the most active enemies of the gipsy moth and the brown-tail moth liberated under the most favourable conditions during the year.

The result of the colonization work of previous years has not become very evident. It is altogether likely that the species introduced have found conditions favourable to their increase and that at the present time they exist in considerable numbers. The area, however, is so extensive as to make their occurrence in ordinary collections a matter of chance rather than

of likelihood. There has been during the past two years a tremendous destruction of the larvæ of both brown-tail moth and gipsy moth from bacterial and fungus diseases. These diseases have appeared in spots, but unfortunately some of these localities were those where colonies of parasites had been established, and in the wholesale destruction of the caterpillars by disease the introduced parasites must have suffered severely. Knowledge has been gained, however, which will make it more easy to select better localities for colonization in the future. Several of the parasites have been found to have established themselves, and notably the predatory beetle, *Calosoma sycophanta*, has been found in numbers. At least seven species have been found under conditions which indicate their establishment.

There have been imported in all 23 species of Hymenopterous parasites, of which 16 are European. 6 are from Japan, and one at least is common to both regions. Eleven of these have been reared from the gipsy moth, six from the brown-tail moth, and six from both insects.

A number of species of secondary parasites have been reared, and have been killed.

Of Dipterous parasites, at least 29 distinct species have been imported, of which nearly all are parasitic upon both gipsy moth and brown-tail moth.

Of Coleoptera, five species have been imported, all of which will feed upon both gipsy moth and brown-tail moth.

This makes a total of 57 beneficial species, enemies of gipsy moth or brown-tail moth or both, that have been brought over in the course of this work.

The outlook is more favourable than at any period during the progress of the work. Success seems an ultimate certainty, but the time at which perfectly obvious results will be apparent is as yet uncertain.

THE STRAWBERRY WEEVIL (*Anthonomus signatus*).

BY WILLIAM LOCHHEAD, MACDONALD COLLEGE, QUE.

This insect is reported as having done considerable damage in 1908 in certain localities, particularly Prince Edward County. It is a small brownish weevil about 1-10 inch in length, with a snout about half as long as the body. The specific name *signatus* is given it on account of the dark spot near the middle of each wing cover.

There is probably but one brood a year. The weevils make their appearance about the time of the earliest blooming of the staminate varieties, and continue their depredations for three or four weeks. "The female first deposits an egg in the bud, then punctures or cuts the stem below it so that in a few days it drops to the ground. Within the severed bud the larva hatched from this egg develops and transforms to the pupa and afterwards to the beetle" (Chittenden, Circular 21, U.S. Bureau of Entomology). The larva hatches from the egg in from 4 to 7 days, and feeds on the pollen within the buds. It becomes full grown in less than a month, and transforms to pupa, and to adult within the cavity of the bud. The pupal stage lasts about a week, and the entire cycle lasts about five weeks.

The adult weevil soon makes its way out of the bud, feeds for a few days; then finds a suitable hiding place for the remainder of the year.

Remedial Treatment: (1) As the weevils are always found on flowers that bear pollen, it is advisable in districts where the weevils are injurious

to grow mostly pistillate varieties, and only enough of staminate plants to pollinate the pistillate plants.

(2) Chittenden says that covering the bed is nearly a perfect preventive. This covering may be of muslin, and should be in position at least a week before the first blossoming occurs, and left in position until the first berries are picked.

(3) Another remedy is to grow profuse blooming varieties.

(4) Trap crops of very early blooming varieties such as the "Chas. Downing" may be planted. Upon these the weevils collect, and many can be killed by the application of arsenical sprays.

(5) Clean culture may be of considerable value in controlling the weevils —the removal of volunteer plants, and the burning over in early spring of underbrush and weeds.

(6) Certain substances, such as dilute crude carbolic acid (1 part in 100 of water), and Bordeaux, seem to act as repellents, and their application would appear to be of value.

WHAT ENTOMOLOGY THE FARMER AND FRUIT-GROWER SHOULD KNOW.

By William Lochhead, Macdonald College, Que.

This title was suggested to me after reading an address on this topic by Dr. S. A. Forbes, State Entomologist of Illinois. I must also confess to the appropriation of many of the ideas in Dr. Forbes' address, for they represent the matured thought of a distinguished Entomologist of long experience, and one who has done much valuable work along economic lines. The ideas, however, are not new; they have been expressed, perhaps partially, time and again at the meetings of this Society, at Farmers' Institute meetings, and at Fruit Growers' Conventions. They require however to be expressed often, and in all kinds of meetings, to effect a lodgment with the people and to be incorporated into the practical work of the orchard and farm. That, then, is my reason for dealing with this subject at this time.

1. *The farmer and fruit grower should know the principal injurious insects that affect the crops of the farm, orchard and garden.*

As intelligent business men they should be able to identify those agencies that make for losses, and to acquaint themselves with the best up-to-date methods of controlling these agencies. The habit of the insects should be studied, in order that the methods of control may be as effective as possible. Haphazard experimenters are out of place just as much in successful farming as in successful manufacturing. For example, he should know when the Codling Moth of the apple makes its appearance to lay eggs, when the young worms attack the apple, in order that he may apply his poison sprays at the best time to kill them. He should know the life-habits of the white grubs which live two years in the ground as grubs, become pupæ and beetles in the fall of the second year; the beetles not emerging until the following May or June to mate and lay eggs. When infested grass land is broken and the adult beetles are prevented from laying their eggs in that field, he must not expect an entire absence of white grubs, for the young white grubs will continue to feed until their food supply is exhausted. "He will not turn pigs into his grass lands late in fall, to clear

them of the grubs, for these bury themselves a foot or two below the surface on the approach of frost."

2. *The farmer and fruit grower should know the injuries done by the principal injurious insects.*

Every crop is attacked at some part at some stage of its existence. For example, the apple tree may be injured in its seedling stage by the leaf-blister-mite on its leaves and the woolly aphis on its roots; the growing tree by borers, plant lice, oyster-shell scale, San Jose scale; and the fruit by the codling worm and the railroad worm. The turnip is attacked by the flea-beetle, during its young stage, and by the turnip aphis and others during its growing period. The corn plant may be injured by the attacks of the seed-corn maggot and wire worm on the seed in the ground, by the white grub and wire worm on its roots, by the cut worm on its stems, by the corn worm on its leaves, and by the grain moths on the stored grain.

The farmer and fruit grower should be able to diagnose the causes of the most serious insect troubles by the nature of the injuries inflicted, as he would diagnose the cause of any ailment of his live stock. It is possible after a careful study of the injuries to plants to identify the particular insects that are causing the injuries, and to deal with them effectively. Sometimes one has to rely entirely on the nature of the injuries for the identification of the insect. Cutworms, for example, work at night and lie concealed in the day time. It is easy to distinguish the work of sucking insects from that of biting insects, but this easy distinction is of prime importance in any rational control of a pest. We sometimes hear of gardeners and fruit-growers using paris green for the control of plant lice. A little elementary knowledge of Entomology on their part would have saved them money, and would have given them success instead of failure.

3. *The farmer and fruit grower should know the characters of the chief orders of insects,* and should be able to recognize the order to which any common injurious form belongs from a glance at the *larva* or *adult.* There are for all practical purposes but seven orders or divisions into which the chief injurious insects may be placed. He should know what orders or groups pass through a *complete* metamorphosis,—from egg to larva, to pupa, to adult,—during their life-history, and what orders have an *incomplete* metamorphosis, *i.e.*, have the young somewhat like the adults; the meaning of the terms *cocoon*, *chrysalis*, *larva*, *pupa*; the difference between a *caterpillar* and a *grub;* between a *grub* and a *maggot;* and of what order each is characteristic; what orders have biting mouth parts, and what orders have sucking mouth parts. All this information is needful and preliminary to an intelligent control of injurious insects.

4. *Every Farmer and Fruit Grower should know the Effect of Crop Rotations, Good Cultivation, etc., i.e., Cultural Methods in Insect Life.*

Cultural methods stand opposed here to *artificial* methods, such as spraying. Where crop rotation is not practised the white grub and wire worms sooner or later take possession of grass lands, and the cultivated lands for a year or two after they are broken. But a good crop rotation, where the crop is changed frequently makes it impossible for any insect to pass through its life-stages without being seriously disturbed and its food supply destroyed. Some rotations are preferable to others when certain

insects become injurious. For example, where corn is the chief crop, a rotation of *clover, corn, oats* is better than *forage grasses, corn, oats,* for the reason that many insects which are injurious to hay and grass land are also injurious to corn.

Where a system of short crop rotations has been in use injurious insects such as the wire worm and white grub are seldom troublesome. The setting apart of a field for a number of years in succession to the same crop, be it pasture, hay, oats, wheat, clover or corn, must of necessity be attended with serious loss from insect injury.

Good cultivation involves careful treatment of the soil, the crop, and its products. It means careful attention to the waste products and the waste places which are breeding places for many insects injurious to farm crops. It means the adoption of deep late fall plowing under certain conditions, which practice is one of the best methods of dealing with wire worms, white grubs, cut worms and grass-hoppers. It means high fertility of soil, and good drainage of the land, so that vigorous, healthy plants, capable of resisting the drains of insect attacks are grown instead of poorly nourished ones, which are much more liable to succumb.

The effect of high culture is to make the plants recover quickly from insect attacks. Dr. Forbes says correctly, "The effect of nearly every form of insect injury is virtually a *starvation* effect. If the roots of a plant are eaten away or otherwise injured, the surface for the absorption of food is thus reduced and the plant suffers from starvation as a consequence. If the elaborated sap is withdrawn from its cells and vessels by the beaks of sucking insects, the effect is essentially the same—the plant is starved. If the substance of the leaf is injured or destroyed the process of assimilation is interfered with, and less assimilated food becomes available for maintenance and growth,—again a starvation effect."

The effect of timely plowing and planting in the control of insects is not well enough known by our farmers. Much valuable information on these points is now available. Two or three late fall plowings are efficacious against wire worms and white grubs; early plowing of grass land in August will prevent severe cutworm attacks the following year; late sowing of fall wheat will prevent Hessian Fly injury; and early cutting of the first crop of clover will destroy the first brood of the clover-seed midge, and thus save the clover-seed of the later crop.

5. *Every Farmer and Fruit Grower should know the value of Co-operative measures in dealing with injurious pests.*

The importance of co-operation has been brought vividly to our attention in several cases; *viz.*, the Hessian Fly outbreak a few years ago, the Pea-weevil scourge, the Codling Moth and the San Jose Scale ravages; and the apple maggot injuries in some sections. As a matter of fact, many of our economic problems in Entomology will remain unsolved until a widespread public co-operative sentiment arises in our midst. "Many difficulties which would yield at once to community action are beyond the power of individual remedy."

I have stated briefly five of the main points which I believe every Farmer and Fruit Grower should know. While we realize that but few persons possess this knowledge, are we doing much to hasten the day when all shall have this knowledge? I believe this Society has done much good through its individual members and through the Reports which are published every year. I believe, however, that the most effective work must be done

at the agricultural colleges with the young men who assemble there for instruction. Such knowledge as I have indicated cannot be imparted in a few popular lectures. Time is required to give the knowledge of, and and acquaintance with the insects that will be of much practical value to the young farmers when they return to put into actual operation the lessons they have learned in the class-room and laboratory.

I believe the agricultural colleges are giving courses in Entomology along the very lines I have indicated. The courses in Entomology at the O. A. C. and Macdonald College are so arranged that the important elementary economic topics are discussed and studied in the second year by all the students in that year. Practically, then, all students who attend the O. A. C. and Macdonald College are given instruction in this most important aspect of agricultural operation. Unfortunately all students are not missionaries; many fail to proclaim the important entomological tidings to their benighted neighbours, and so the great work of the evangelization of the whole land is delayed. The wide-spread interest in agricultural education for rural schools indicates that some of the seed, at least, that was planted by the older men among us fell on good ground; for the present, interest has, to some extent, developed by way of *Nature Study*.

To one who took an active part in this movement for agricultural education it is clear that the presentation of the various phases of insect life by many of the members of this Society throughout the Province made a deep impression, whereby it was possible to introduce Nature Study into many of our schools.

INJURIOUS INSECTS IN ONTARIO IN 1908.

By C. J. S. Bethune, Ontario Agricultural College, Guelph.

The season of insect activity, which has now come to a close, has not been marked by any unusual outbreak, such as that of the Variegated Cutworm last year, but several of our well known pests have been more than usually destructive to certain kinds of vegetation. The long hot summer, with plenty of rain in this part of the Province till the middle of August, and the subsequent protracted drouth which has lasted with but few slight breaks till the present time (November), has been favourable to the multiplication of many insects while detrimental to others.

Insects Affecting Farm Crops.

Plant-Lice. There have been more complaints this summer concerning the damage done to turnips and cabbages by Plant-lice (Aphids) Fig. 33, than regarding any other kind of insect. From every part of the Province letters have come asking what could be done to get rid of the pest and to save the crop. Usually the application has been too late—the plants have been injured beyond recovery, and no treatment could restore their lost vitality. The warm dry weather in September was very favourable to the increase of this most prolific insect, and they multiplied to enormous numbers before their attack was noticed. They usually congregate on the under side of the leaves and are out of sight to a casual observer, but many of them are on the upper surface as well and the dead and withering leaves should serve to draw attention to them. These plant-lice are dark green in colour, much the same shade as the leaf they are feeding upon, and are

covered with a mealy-looking powder of a bluish or ashen hue, which gives them a particularly disgusting appearance. Each of the myriad lice is engaged all day long in sucking the juices of the plant on which it is stationed and the combined effect of so many feeders is soon shewn by the impoverishment and destruction of the leaf.

These sucking insects can be destroyed by the application of any of the usual contact remedies, such as kerosene emulsion, tobacco wash or strong soap-suds; the last is probably the cheapest and easiest remedy to procure and has been found very effective. A difficulty, however, is experienced with all these applications in getting at the insects on the under side of the leaves which are often close to the ground. In order to ward off an attack next year all the refuse of the crop, such as cabbage stalks and turnip leaves, should be destroyed by forming them into a compost heap or some other method which will prevent any lice upon them from finding secure winter quarters, and also kill the eggs which are laid on stems and leaves. This should have been done as soon as the crop was taken off the field. Next year these vegetables should not be planted on the same piece of ground, and should be watched for the first appearance of any colonies of lice. If a sharp look-out is kept during hoeing and any affected plants cut out and crushed under foot, a very great deal will be done to reduce the number of colonies if not to entirely clear out the insect.

WIRE-WORMS AND WHITE GRUBS. (Figs. 34 and 35). Next in order to the foregoing were enquiries respecting these two classes of insects, which attack the roots of various plants and destroy large numbers of them. Being underground feeders no method has yet been found of applying a poison for their destruction. A great many experiments have been made in various places and all sorts of things have been tried, but nothing has yet been found to answer the purpose. Salt is often suggested, but it would require so large a quantity to kill the worms that all vegetation would be destroyed as well. Apparently the only thing that can be done is to prevent their breeding and coming to maturity by a short rotation of crops. Both these insects increase and multiply in grass lands, especially old pastures, where the worms and grubs feed upon the roots. If left long undisturbed they become very numerous and destructive. When an infected field of this kind is broken up for the first time, not much damage is done to the crop that is put in as the worms have still plenty of food in the roots and leaves of the grass that has been ploughed under. The next year this supply of food is gone and the worms must attack the roots of the crop whatever it may be or perish of hunger. Hence it is that corn and many other things suffer severely the second season after the grass field has been broken up. The most effective method, so far as the writer knows, is to plough up the infested field in August to destroy the tender pupæ which have been formed by that time and again late in October to expose the newly formed beetles and also the young worms to the cold and frost of winter; this ploughing will also enable birds and other creatures to get at and devour them; poultry and pigs will feed upon them eagerly and should be allowed to range over the field immediately after it is broken up.

WHEAT INSECTS. The Hessian Fly has been present in injurious numbers affecting winter wheat in the Counties of Norfolk, Brant and Essex and in the Niagara District; in other parts of the Province it does not seem to have inflicted any appreciable injury. The plan of sowing wheat after the middle of September in order that the plants may be too late for the egg-laying of the flies has proved satisfactory, though it is attended with the risk in an unfavourable season of having an imperfectly grown plant to

withstand the dangers of winter. A useful method is to sow a strip of wheat two or three weeks before the regular crop and thus provide the flies with a suitable place in which to deposit their eggs; later on this should be ploughed under and the insects destroyed, thus leaving the main crop free from injury.

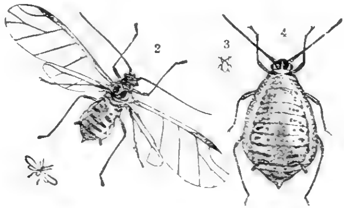

Fig. 33. Cabbage aphis: winged male, wingless female. Small figures are the natural size.

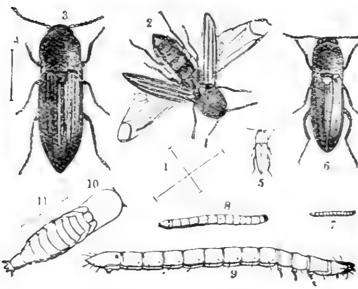

Fig. 34. Wire-worms: beetles and grubs.

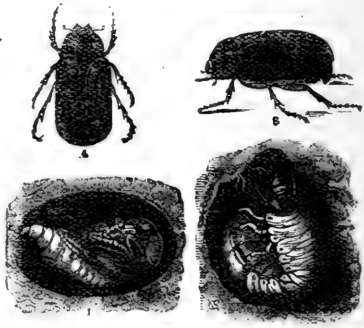

Fig. 35. White grubs; beetles, larva and pupa.

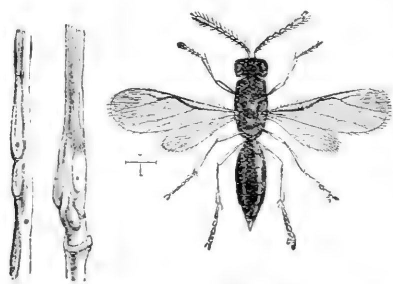

Fig. 36. Wheat joint-worm; affected joints; fly greatly magnified.

The Wheat Joint-worm (*Isosoma tritici*, Fitch), Fig. 36, is not of common occurrence in Ontario. Three years ago Dr. Fletcher reported a somewhat severe outbreak at Millbrook and complaints were made of it in some of the south-western counties. This year specimens of its work have been

sent to us from Petrolia only. The parent insect is a minute black four-winged fly, belonging to the same order as Wasps and Ichneumons and to a family most of the members of which are parasitic upon other insects. The eggs are laid at or near a joint of the growing wheat plant, and the larva burrows into the stem and causes a gall-like swelling to be produced inside which it lives and feeds. This swelling becomes hard and renders the straw so brittle above and below it that it is frequently broken off in a storm. The hardened portions which remain when the grain is cut are apt to be separated from the straw and to come through the threshing machine with the grain. When winnowed out these fragments with other refuse should be burnt. Most of the galls, however, are left in the stubble and contain the wintering larvæ; in order to destroy these the field should be burnt over in the fall if practicable, or the stubble deeply ploughed under. Usually a short rotation of crops with clean cultivation serves to keep this insect in check, and thus we do not often hear of any damage being done by it.

Indian Corn Insects. The Greasy Cutworm *(Agrotis ypsilon)* Fig. 37, has severely attacked some fields of corn, cutting off the young plant at the surface of the ground, and also attacking the roots; and the Glassy Cutworm *(Hadena devastatrix)* Fig. 38, caused much damage to several acres of corn near Listowel. Other species have seriously injured turnips and wheat in some localities. These night-feeding caterpillars are half grown in autumn and feed voraciously on almost any kind of vegetation that comes to hand in the spring. Fortunately there is a very satisfactory remedy which can easily be applied; it is called the poisoned Bran-mash. It is made by mixing half a pound of Paris green in fifty pounds of bran, stirring constantly and adding the poison little by little; this is sweetened by the addition of two quarts of cheap molasses previously diluted in about a gallon of warm water; the whole must be thoroughly mixed to such an extent that the bran will crumble through the fingers and not form hard lumps. The mash is distributed through the infested plot by means of a Planet Junior drill or by hand in the evening, taking care that poultry do not get at it. The worms come out at night and devour it in preference to the plants, and usually go off to die either under the surface of the ground or some other convenient hiding place, so that no dead ones are found lying about in the morning. One who tried this remedy with very much doubt as to its value, unearthed quarts of dead cutworms after a night's application and became thoroughly convinced of its effectiveness.

The Pea Moth. *(Semasia nigricana)* Fig. 39, has been troublesome in the neighbourhood of Lindsay. Eggs are laid by the parent moth on the young pods and from these hatch out small caterpillars which make their way inside and devour the peas; when full grown they leave the pods and form a cocoon beneath the surface of the ground and there remain all winter, the moth coming out the following summer. It has been found that early maturing varieties of peas are free from the attack as they are too far advanced when the eggs are laid, it is therefore advisable to sow as early as possible wherever it is known that there is danger of injury from this insect. In gardens the ground should be dug deeply in the fall to bury the cocoons so that the moths cannot reach the surface when they come out, and all immature pods should be burnt when the crop has been picked. In

field cultivation deep plowing and the removal of all refuse should be attended to; any infested plot should not be sown with peas again for two or three years. It is not likely that any poison can be successfully applied as the worm buries itself in the pod as soon as it is hatched.

THE PEA WEEVIL. (*Bruchus pisorum*) Fig. 40, is to be found every year in many localities. If growers everywhere adopt the simple method of fumigating with bisulphide of carbon as soon as possible after harvesting there would soon be little injury to complain of; one ounce to one hundred pounds of seed has been found sufficient. All refuse after threshing should be cleaned up and burnt and no weevilly peas should ever be sown.

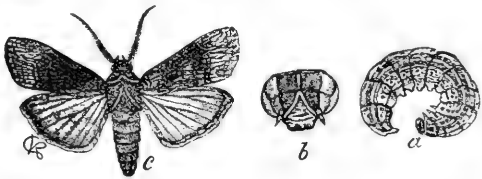

FIG. 37. Greasy Cutworm; (*b*) front of head; (*c*) moth.

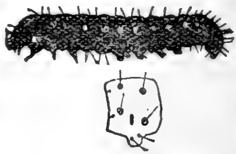

FIG. 38. Glassy Cutworm.

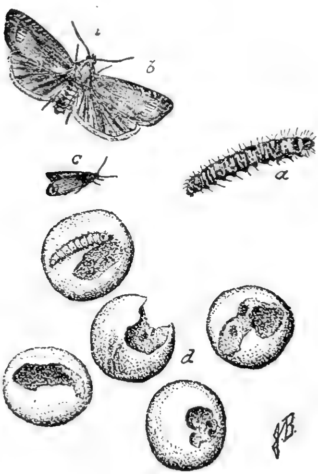

FIG 39. Pea moth, larva and infested peas.

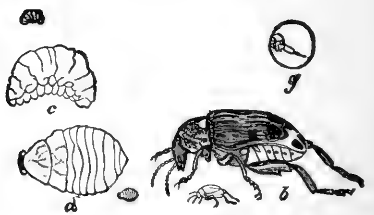

FIG. 40. Pea Weevil.

CLOVER-SEED MIDGE. Many complaints have been received respecting loss caused by this insect. The adult is a two-winged fly which lays its eggs in the flower heads of clover; the maggots, when hatched, burrow into the ovaries and feed upon the developing seeds. They become mature at the end of June, descend into the ground and pupate there. A second brood of flies come out when the clover is again in flower and the same course is repeated; in this way both crops are prevented from maturing a large proportion of their seed. The winter is passed by the maggots in

the earth; they do not, like the Pea-weevils, remain in the seed or continue their work of destruction. These red larvæ may, howver, be found amongst the seed after threshing, but any that we have seen at that time were dead.

There is a simple remedy which has been found very effective, that is to cut, or feed off, the first crop of clover by the 15th of June, and thus destroy the maggots before they go into the ground to pupate. The result is that they fail to mature and there are no flies to lay eggs for another brood. The second crop will then produce good clean seed, having the further advantage of many more bumble bees in August than there were in June to assist in the process of fertilizing the bloom.

Insects Affecting Fruit-Trees.

In the earlier part of this report there is given an account of the discussion of many of the most serious insect pests of the orchard; it is, therefore, unnecessary to refer to them here, except very briefly. Of the scale insects we have as usual received complaints of the Oyster-shell Bark-louse from all over the province. The San Josè scale is reported from Dresden, a new locality; the Curtis and Scurfy scales have been sent in from Simcoe and from Vineland, and no doubt are to be found in many other places, but they are seldom numerous enough to do any serious damage.

The Pear and Cherry-Tree Slug (*Eriocampa cerasi*) has been very abundant in many places this year; the second brood continuing their injury to the foliage till quite late in the fall. The slimy black or greenish slug-like larvæ can be destroyed by dusting with Paris green or lime, or spraying with white hellebore mixed in water.

Apple-trees in unsprayed orchards in Sandwich, London, Simcoe, Guelph and other places suffered a good deal from the Cigar Case-bearer, the Apple-bud Moth and the Trumpet Leaf-miner. The fruit itself was attacked in many localities apparently by the Snowy Tree-cricket and the Plum Curculio, causing malformations of the apples and a serious impairment of their value; the Tussock Worms were also found attacking the fruit in a similar manner. Not much attention has been paid to injury from these sources; it is important therefore that careful observations should be made both as to the insect causing the injury and the time when it is done, in order that intelligent measures may be adopted for prevention.

Among the small fruits, Strawberry plants have been much damaged by Wire-worms and White-grubs at the roots, especially where they were planted in old pasture fields which had recently been broken up. It is impossible to apply any remedy for the destruction of these underground feeders; the only method of getting rid of them is by a short rotation of crops involving frequent cultivation of the soil and the consequent disturbance of the grubs and pupæ, as stated in the earlier part of this paper. The Strawberry Weevil has caused some damage by cutting off the pollen-bearing blossoms and preventing the setting of the fruit.

The Rose Chafer, which usually appears in swarms about the time that the Grapes are in blossom, has not been so abundant as usual this year, though bad at Cooksville, Niagara Falls, Simcoe and some other places.

Raspberry and Blackberry bushes have been attacked in some localities by the Cane-girdler—a slender beetle, less than half an inch in length, black in colour with an orange or yellow thorax on which are three black dots. The beetle bites a series of small holes close together all round a cane not very far from the tip, and then makes another series about the length of its own body from the first; between these two girdlings it excavates a hole and deposits an orange coloured egg. The grub lives on

the pith of the cane, which soon withers and dies above the girdling, and is checked in its growth. All affected canes should be cut off an inch or two below the place attacked and the prunings burnt in order to destroy the grubs within them.

A Leaf-miner (*Scholioneura capitalis*) has been very prevalent this year at St. Catharines, Oakville and in Prince Edward County, injuring the leaves of Blackberry bushes; in some cases a large proportion of the leaves were attacked and became prematurely withered.

Insects of the Vegetable and Flower Garden.

There has been no special outbreak during the past season, but many of our familiar pests have been more or less abundant and destructive. The Asparagus beetles, which came to us across the Niagara river and spread westerly and northerly, are now travelling eastward along the shore of Lake Ontario as well; the latest reports have come from Oshawa. Wherever they go they establish permanent colonies and will require to be dealt with every year.

Plant-lice (*Aphids*), as already mentioned, have been unusually abundant this year, and have not only attacked turnips and cabbage, but also lettuce, peas, potatoes, roses, and most other garden plants, a variety of species being present.

Tomatoes have in several places been attacked by the large caterpillars of the Sphinx moth; where these voracious feeders are numerous they devour a large amount of foliage and sometimes strip the plants of their leaves. Being so large and conspicuous they can easily be picked off by hand and crushed under foot. Owing probably to the very hot weather in September a number of moths emerged from the chrysalids that we had in a breeding cage, instead of remaining buried in the ground all winter.

Miscellaneous.

The Mediterranean Flour Moth (*Ephestia Kuhniella*) has made its unwelcome appearance in several mills in this part of Ontario. In one situated in Guelph, an annual fumigation with hydrocyanic acid gas is made with excellent results; it would probably be better, however, to repeat the operation at an interval of a few weeks when another brood may be developed, as it is doubtful whether the gas will kill the eggs of the insect. All sacks and packing material brought from other places should be steamed, or otherwise treated, as the insect is evidently in this way introduced into mills previously free from it.

The Indian-meal Moth (*Plodia interpunctella*) has been found in numbers infesting a mill, and the caterpillars in another place were discovered devouring seed wheat, of which they eat the germs and thus spoil a larger quantity than they actually consume. If a whole building should be infested by them it would be advisable to fumigate with hydrocyanic acid gas, but where they are confined to the grain bins they may be destroyed with bisulphide of carbon.

Grain Weevils (*Calandra granaria* and *oryzæ*) have also been found infesting stored grain. These small snout beetles will continue for years breeding and devouring the grain in the same receptacle if left undisturbed. Bisulphide of carbon may also be used as a remedy for these as well as any other granary insect. One great means of preventing injury from all these insects is cleanliness; all bins and other places where grain is stored should be thoroughly cleaned out at least once a year, and fresh grain should not

be brought in till the old has been cleared out. All corners and dark places where flour-dust and other refuse accumulate should be regularly swept out at short intervals and thus leave no undisturbed breeding places for these destructive creatures.

Another insect troublesome in the barn is the Clover-hay Worm (*Asopia costalis*), the caterpillar of a very pretty little moth, which has rich red wings adorned with yellow markings. The caterpillar feeds upon dry clover, both in the stack and the mow, and spoils it for fodder, as cattle will not eat it when badly infested. In this case also cleanliness is most important; no old clover or refuse should be left in the barn when fresh supplies are about to be brought in, and the remains of old clover stacks should be burnt or thoroughly cleaned up before a fresh one is built on the same spot.

During a summer trip to Fort William and Port Arthur it was disheartening to find that the Larch Saw-fly (*Nematus Erichsonii*) had extended its ravages along the north shore of Lake Superior. On the line of railway as far east as Nepigon the tamaracs were noticed to be every where dead or dying; on reaching this latter place an examination was made of a number of trees and all were found to be swarming with the caterpillars of this insect. This region of country was burnt over some twenty-five years ago, and the land is now covered with a vigorous growth of young trees of various kinds twenty and thirty feet in height. Scattered through these, as well as in clumps, are great numbers of larches, all of which seemed to be infested with these worms; in all probability in a year or two there will not be a living one left, thus repeating the devastation that was experienced some years ago in the Eastern Townships of the Province of Quebec. As the insect abounds over hundreds of miles of wild country it is evident that nothing can be done to check its devastating work.

Spruce trees in this part of Ontario continue to be attacked by the Spruce Gall-louse (*Chermes abietis*), which has several times been described in these reports. Young nursery trees and individuals grown for ornament may be treated when the young lice are exposed towards the end of May and of August with a soap and tobacco wash or kerosene emulsion. At Whitby some Spruce trees were defoliated this year by the caterpillars of the Spruce Saw-fly (*Lophyrus abietis*). Spraying with any of the arsenicals, applied as soon as any of the worms are seen, would soon get rid of them.

INJURIOUS INSECTS OF QUEBEC IN 1908.

By William Lochhead, Macdonald College, Que.

The damage done by insects in Quebec in 1908 has not been heavy. The season was exceptionally dry over a large area of the Province, which condition may have influenced the insect life in some way not yet ascertained. Dr. Forbes, of Illinois, says that "a wet season—if not too wet—is a favorable one, and a dry season an unfavorable one," inasmuch as the condition tends to the increase in growth and food-supply to the plant. Most serious insect injuries to growing crops diminish with wet weather and increase with dry. In very wet weather "the sap of the plant may become so dilute, through excessive absorption of water by the roots that it loses its nutritive value, and insects dependent on it are not so well nourished as by the denser sap of a plant growing in a drier soil. They consequently grow less thriftily and multiply less abundantly, and may

even diminish rapidly in numbers during a wet season, while if the weather were dry and their food nourishing they would increase steadily at a geometrical ratio. After a year or two or three of drouth the intelligent farmer will be more watchful for the first appearances of insect outbreak than after a series of unusually wet years." The Relation of Weather to Insect Life is still a baffling problem, but the economic importance of a satisfactory solution warrants the spending of much time, money, energy, and ability.

It is just as difficult to get reliable returns concerning insect pests from Quebec as it is from Ontario. Many of our common injurious forms are still known as *worms*, or *bugs, vers* or *pucerons*, and there are but few persons who can name even the most common injurious insects.

INSECTS AFFECTING CEREAL CROPS. No reports of the presence of the Hessian Fly or Wheat Midge have been received from any part of Quebec. The wheat grain aphis did considerably damage in certain localities. At Macdonald College the experimental plots were badly infested, but towards the end of the season it became very evident that the parasites were very numerous, and that they were controlling the aphis, but they did not appear soon enough to prevent serious damage.

INSECTS AFFECTING VEGETABLES. The cabbage and turnip aphis was a very common pest in late summer and autumn, but judging from reports which have reached me, no very serious damage has resulted. Mr. Chapais informs me that he has not found the *Cabbage aphis* in eastern Quebec. The *green cabbage worm* has been prevalent over a large part of Quebec, and considerable damage has been done. It is a very common pest in eastern Quebec, but not plentiful. The *Cabbage Root Maggot* can usually be found in most fields of vegetables where cabbage and rape are grown, but for the last two or three years, this pest has not made itself manifest to any extent. In some parts of the Province this insect is unknown, as it occurs only at intervals of many years. The *Squash Bug* (Anasa tristis) is not met with in Quebec. Mr. Chapais reports meeting with it now and again, but he says it never causes much damage. I have not seen any specimens of it at Macdonald College during the last two or three years. The cucumber beetles, however, are very abundant and injurious. In eastern Quebec they are not so abundant as in the western parts. The melon aphis, although present, is not at all injurious, and has not been found by Mr. Chapais east of Quebec. The Colorado potato beetle is keeping up its reputation as being the most abundant and persistent pest we have. In spite of all changes in temperature—hard winters and mild winters, wet summers and dry summers, this pest continues to hold its own. In fact, it seemed as if it required a stronger dose of Paris green to kill it than it did a few years ago.

INSECTS AFFECTING LARGE FRUITS. The Codling Moth is reported as being very abundant at Cowansville and at Chateauguay, Covey Hill, Abbotsford, La Trappe and the lower St. Lawrence; in fact, all the reports received emphasize the abundance of this pest of the apple as doing a great deal of damage. The Apple Maggot was not observed at La Trappe, but was very abundant at Como, just across the Ottawa River, and according to Mr. Reid of Chateauguay, is prevalent at Covey Hill. It is evident that it is not prevalent throughout Quebec, else its presence would have been reported by more of my correspondents. The Plum Curculio, which injures both the apple and the plum was a very bad pest at Chateauguay. Mr. Reid states that it is the worst pest the fruit growers have in his district. Mr. Chapais reports it as abundant along the lower St. Lawrence. It does not seem to affect the apples much at La Trappe, but it is very severe on the plums. The green apple aphis is more or less prevalent in

some parts of Quebec, but is not troublesome at Cowansville or in the eastern part of the province. It is very abundant at Chateauguay and La Trappe. The Oyster-shell Bark-louse is also one of our most widespread insects in Quebec, and is reported as being very abundant at Cowansville, but at present it is not injurious at La Trappe to any extent. The Canker-worm is not troublesome. The Fall web-worm is very prevalent throughout the province this present autumn.

INSECTS AFFECTING SMALL FRUITS. The Currant-worm is common everywhere, and is very injurious when left uncontrolled. At the Agricultural Institute, at La Trappe, the insect was successfully controlled by Nico Soap. The Raspberry Cane-borer was reported as doing little or no harm, but has been observed as being abundant on the wild canes.

MITES ON RASPBERRIES. In 1907 the raspberry plantation at Macdonald College was badly infested and injured by mites, which have the habit of clustering on the under surface of the leaves. They were again observed in June, 1908, and spraying operations were begun to determine the effect of various solutions in controlling the pests. These operations were in charge of Mr. J. M. Swaine. Ten plants were selected of about the same degree of infestation. The following substances were used:

Nico-soap	Fair results.
Lime-sulphur (5 oz. lime, 21-23 S, 2) $\frac{1}{2}$ gal H_2O	Effective but killed leaves.
Lead Arsenate (1 to 10)	Not effective.
Bordeaux	Not effective.
V2 (1-10)	Effective.
Whale Oil Soap, 3 oz., 10 gals.	Fair results.
Tobacco decoction	Fair results.
Kerosene Emulsion (1 to 9)	Most effective.
Water	Effective.

Later, the whole patch, excepting three rows, was sprayed with whale oil soap, tobacco decoction and V2. They all killed the mites, where they were very carefully applied, but on the whole about half of the mites were killed. Tobacco was as effective as any of the substances tried. Probably these mites can be better controlled by winter sprays, and experiments will be conducted this coming winter to test the effectiveness of winter sprays.

THE WHITE MARKED TUSSOCK MOTH. Mr. Swaine reports that the Tussock Moth was not nearly so abundant on the shade trees of Montreal as it was in 1907. Fully 90 per cent. of the larvæ that were collected at random from trees were found infested with parasites. Mr. Swaine bred 16 species of parasites.

INSECTS OF THE EASTERN TOWNSHIPS. According to Mr. Douglas Weir *Grass-hoppers* were the cause of some damage to the grain crops in the Eastern Townships, and the *Potato Flea Beetle* was observed in somewhat greater numbers than usual, assisting the Colorado Beetle in the devastation of the potato crop.

In the orchards the *Tent Caterpillar* and plant lice were perhaps most evident, while in the forests and wood lots a species of *Saw-fly* (Nematus Sp.) defoliated many fine groves of birch (mostly *Betula papyrifera* and *B. populifolia*).

INSECTS OBSERVED AT THE PORT OF MONTREAL. Mr. Merritt Baker, Fruit Division, Ottawa, who is in charge of the inspection of apples at the port of Montreal in connection with the inforcement of the Fruit Marks Act informs me that the three most important insects which he has observed in the course of his inspection are the Codling Moth, the Plum Maggot and the Lesser Apple-Worm. The apples which he examined came mostly from the Lake Ontario District, Ontario. The Lesser Apple Worm (*Enar-*

monia prunivora) is an insect which deserves more attention than it has usually received. It is probable that many of the injuries which have been done by this insect have been attributed to the young codling worms. This insect usually bores just below the skin at the blossom end of the apple, or at the point where two apples are in contact. The effect produced is a sunken area, somewhat irregular in outline, still covered by the dead skin of the apple. Observations show that it rarely bores into the fruit very far; never exceeding half an inch. Mr. Baker states that the injury to the apple may continue after the fruit has been packed in barrels. Dr. Felt, New York State Entomologist, states that it works also upon the domestic variety of plums. In appearance, the lesser Apple Worm resembles somewhat the Codling Worm. It is very probable—although direct experiments have not been conducted to test the effectiveness of the remedy—that this insect can be controlled by the same applications as those adopted against the Codling Moth.

The Apple Maggot or Railroad Worm (Rhagoletis pomonella) has become one of our most serious apple pests. It does not appear to be widely distributed as yet. It appears locally in several districts, and does not seem to have the faculty of spreading far from that locality. The insect winters over as a little brown oval puparium, either on the surface of the ground or at the bottom of barrels containing apples. The adults emerge very regularly throughout the season, from early July up into September, so that they affect both early and late-maturing apples. The adult is a blackish two-winged fly, a little smaller than a common house fly, and may be recognized by the narrow, white bands on its abdomen, and by the four black bands across its wings. The eggs are deposited under the skin of the apple, and the young maggots hatch within a week and begin burrowing and making channels in the developing apple. It seems as if the maggot does not emerge until the apple is matured; there is therefore great danger that many apples which appear quite free from injury when picked and packed in barrels will show serious injuries when the barrels are opened. There is but one brood each season. As spraying has little or no effect in controlling this insect the best methods of control are the gathering and destroying of the fallen apples, which contain the maggot, and the cultivation of the soil in the orchard, at intervals early in the summer, before 1st July, to destroy the pupæ in the soil.

THE FARMER'S WOOD LOT.

By Rev. Thomas W. Fyles, D.C.L., Levis, P. Que.

" How dear to this heart are the scenes of my childhood,
When fond recollection presents them to view:
The orchard, the meadow, *the deep tangled wild-wood*,
And ev'ry loved spot that my infancy knew."

Many a man who, in early life, left his father's homestead to try his fortune far away, has listened to the song of "The Old Oaken Bucket" with keen emotion.

It is the nature of man to

" look before and after,
And sigh for what is not."

And, in his leisure moments, when wearied with the turmoil of the busy world, the fancy of the exile from home will often revert to the scenes of his early life.

Among the cherished recollections of such a one will be the Wood Lot, with its stately trees, its pleasant glades, its cool retreats.

He will think of its hazel copses, its blackberry tangles, its furred and feathered denizens, its wealth of flowers.

He can call to mind its appearance in the early summer, when all the trees of the wood rejoice before the Lord, when the delicate green of the young foliage was relieved by the yellow catkins of the birches and the darker hues of the pines.

The glories of its autumnal tints will also present themselves to his fond remembrance—the splendid crimson and gold of its maples, the Indian yellow of its beeches, the rich rosy bronze of its oaks.

It will seem to him as if the woodland were wont to don its richest robes, to bid adieu to summer with befitting state.

Amid such scenes he received his first lessons in wood-craft, and learned to call the trees by their names, and to distinguish each kind by its peculiarities, and to know the timber of each by its grain, and to tell the uses for which it was adapted.

There he learned to admire the inexhaustible resources of the Divine Creator revealed on every hand, and the marvellous—to speak paradoxically—diversity in uniformity under which no two leaves of one tree exactly agree in all points of outline and venation.

Then, it may be his thought will revert to his early companions, and their frolics in the woods and sugar-house. He can recall the names, the features, the characteristics of his early friends; and he may wonder whither their several paths in life have led them.

But dearest to his fond recollection—dear and yet sorrowful—will be the remembrance of the home circle. He will think of his parents now laid to rest, it may be, in a selected spot of their own land; and he will perhaps view, with shame and regret, his conduct in leaving the old folk to carry on the farm, in their declining years, without the aid of his youthful energy and strong right arm.

"It is true," our friend may say to himself, "that the farm was less productive than it had been, that the prices of produce were low, and the general outlook somewhat gloomy; but observation has since taught me, that, as the population has increased, the prices of produce have risen, that new railways have given access to better markets, that such noble institutions as the Ontario Agricultural College at Guelph, and the Macdonald College at Ste. Anne de Bellevue, have made known that more can be done with, and made from, the land than our fathers were aware of. If I could have had the advantage of a training, such as these colleges afford, my ambition would have been aroused, and I would have staid by the land and made it profitable. And what nobler business can a man undertake! The cultivation of the soil was the work appointed for Adam by his Maker. The occupations of the farmer have not unfitted men for high endeavours. Stock-raising was the business of Abraham, the father of the faithful, the friend of God: the prophet Amos was a herdsman; it was from the sheep-fold that God took His servant David away, that he might feed Jacob His people, and Israel His inheritance. It was from the plough that Cincinnatus was called to the Dictatorship; and the poet, Horace, delighted in his Sabine farm."

But, leaving our city man to his cogitations, let us now make some observations on the wood lot for ourselves.

I do not in this article refer to the White Birch allotments that may be seen on the French Canadian farms around Montreal, nor to the Spruce growth on many of our northern farms; though these have their interesting features. I have in mind the mixed growth, remains of the old forest that

once covered the land: such as may be seen on the rougher portions of farms, in parts of the Eastern Townships and the New England States.

The *aristocracy*, so to speak, among the trees of such wood-lots are the lordly pine, the sturdy hemlock, the stately yellow birch, and the basswood beloved of bees. These rise, straight and tall, amid the numerous spruces, balsams, tamaracks, elms, maples, beeches, poplars and balm-of-Gileads.

Among all these fine and useful trees are others of smaller growth: thorns, hornbeams, amelanchiers, moosemissies, etc.

Stand with me in such a wood, and see the tall pines, with their spreading layers of foliage rising tier above tier; the graceful balsams, like church-spires pointing heavenward; the vase-like contour of the elms.

Time would fail us to consider the peculiarities and uses of many of the trees—let us observe those of *one* genus, that of *Fraxinus*, the Ash.

Of the six kinds of Ash accredited by Grey to North America, three are found commonly in Canada:

The White Ash, *Fraxinus Americana;*

The Red Ash, *Fraxinus pubescens;*

The Black Ash, *Fraxinus sambucifolia.*

The fruit of each of these is a Samara, or winged seed, and the leaves are compound leaves, and these afford distinguishing features for the three kinds I have mentioned.

In the *White Ash* the stalks of the leaflets are smooth and glabrous.

In the *Red*, they are softly pubescent.

In the *Black*, the leaflets have no stalks—they are sessile.

Again:—

The seed of the *White Ash* is winged from the apex only.

In the *Red*, the seed is edged on either side; and the edges gradually expand into the wing.

In the *Black*, the seed is winged all round.

These seeds hang in clusters. The children in England call them locks and keys.

The White Ash is a valuable shade tree. Its symmetrical stem, its graceful contour, and its elegant foliage render it a favorite for the lawn or park.

Then it is remarkably free from insects. In North America some 500 kinds of insects feed upon the oak; but about 50 only feed upon the ash; and of these very few can be said to be injurious or offensive.

The wood of the White Ash, on account of its toughness, its close grain, and its freedom from flaws, is valuable for the construction of carriages, farm vehicles and implements.

The wood of the Black Ash is useful for other purposes. Bars of it are well soaked, and pounded with mallets. They can then be rent into fine strips for basket work and bottoming of chairs.

Let us now turn our thoughts for a few moments to the sentient things around us.

I dare say you noticed when we entered the wood-lot that a sentinel-crow sounded an alarm—and now a dead silence seems to have fallen on the woodland. Let us sit on this log till the inhabitants of the wood have regained confidence. Meanwhile, I will say a few words about the crows.

The crows build frequently in spruce trees. The dense foliage of these trees hides their nest. I had the curiosity to climb to a nest some years ago; and I was rewarded for my pains, for a strange nest I found it. The

builders had stolen a whole length of clothes-line, and with great ingenuity had wound the cord round and round, and between the young branches of the tree, making a very firm basis for their nest.

You all know that the first egg of a pullet is sometimes very small: the mother crow, whose nest I invaded, must have been a yearling bird, for there was in the nest one very diminutive egg, with others of the usual size.

Ah, our patience is meeting with its reward—the birds and animals are no longer silent.

There is an oriole wending its way to its nest that we saw suspended from the extremity of an elm bough on the verge of the wood.

And yonder, near the top of that tall hemlock stump, a Golden-winged Wood-pecker (*Colaptes duratus*) is busy enlarging a hole in which to make its nest. What a litter he is making! "The carpenter is known by his chips." Now he flies away. Observe the graceful curves of his flight, and notice his peculiar call, which suggested the common name by which he is known—"Wake-up."

The stump he was operating upon must be fourteen feet high. Its top shews that *the axe* had severed it from the upper portion of the tree. How did the woodman find standing room for his work? The explanation is this:—the tree was blown down in some fierce gale. It tore from the ground, on all sides but one, a mass of roots, charged heavily with soil and stones, and leaving a deep hollow in the earth. The farmer came; peeled off the bark as far as the branches; cut off the limbs and top; then marked the trunk into lengths. He stept up on the tree, and standing with feet wide apart, chopped off standard logs—one—two—three. As the third log fell, he felt the butt, on which he was standing, beginning to move. He jumped, and so doing, escaped from being shot, as from a catapult, yards away. The counter weight being gone, the heavy mass of roots, with the stump in place, fell back into its matrix with a thud.

See yonder in the maples a pair of grey squirrels. What a frolic they are having! Chasing each other as if they were playing "tag," their long tails extended, or curved gracefully over their backs. Those tails serve them for Winter blankets. The little creatures, in their snug retreats, during the cold weather lie closely curled, and wrapped by their soft tails, heedless of wind and storm. They are sportive enough now—bye-and-bye, when Autumn is well advanced, they will be busy collecting beech nuts, acorns and butter nuts for their Winter supplies.

The butter nuts are truly to the squirrels *Juglans*—Jovis glans—Jupiter's nuts—the provision made by Providence for their Winter's need.

On the other side of us a red squirrel is scolding—"*chuck, chuck.*" I have lost my liking for this little animal ever since I saw one of its kind tearing to pieces the callow young from a young bird's nest that it had discovered.

Yonder runs the prettily striped ground squirrel or "chipmunk." One evening in the first year of my residence in Canada, I walked out from Montreal, where I was then living, to Cote des Neiges. There I encountered half a dozen boys who were greatly excited. Some of them had sticks in their hands; some large stones; all were eagerly searching the stone fences. "What are you hunting?" I asked. "A chipmunk! A chipmunk! !" they shouted. and away they ran. I had never before heard the name. I wondered what ferocious beast was known under the strange appellation.

I was as perplexed as the tourist who came to Quebec to view the Winter scenery. He was a man of more leisure and means than wit. He put up at the St. Louis Hotel, and in the afternoon walked out to the Plains.

He admired the pure unbroken expanse of snow and the fine view over the St. Lawrence and towards St. Jean Chrysostom. Next morning he arose early and took the same course to gain an appetite for breakfast. When lo, he saw some strange tracks in the snow. They were very large, and there was something like the imprint of a spur behind each of them. While he stood greatly puzzled, an old Scotchman drove along on a traineau. Our friend stopped him; and the following colloquy occurred:—

"Can you tell me, Sir, what made these tracks?"

"The snaw-shus."

"What huge tracks! They come from the woods" (pointing towards Wolfe's Field).

"O aye, that' awa."

"They came in the night?"

"Like as not."

"And they go towards the town. Ar'n't the people afraid "

"Na', na'. They're used to them."

And he drove on.

Out came the stranger's note book; and he wrote:—

"The Great Snortshius, a strange creature with huge feet, comes from the woods in the night, and passes into the town; and the people are not terrified. I must enquire further."

So I felt about the chipmunk. I must enquire further; and I did.

The chipmunks and field mice are very mischievous. Towards Spring when their Winter storm of provisions have run short, and when the snow next the earth has melted, leaving run-ways amidst the buried brush, the little animals follow these passages till they come to the young maples, that the farmer has been preserving to form a second growth sugary. They gnaw the bark of the trees near the ground. After a long Winter I have seen scores of young trees completely girdled and destroyed by them. If a young orchard is near the creatures are apt to serve the fruit trees in the same way. Lengths of stove pipe unhooked at the sides, and placed around the base of the trees, and then hooked together again, are a safeguard against the spoilers.

From our seat on the log we can observe many interesting things. Yonder runs a Ruffed Grouse or partridge. It probably has its nest at the foot of some neighbouring tree. The nest is but a slight hollow in a dry spot. The bird lays many eggs. She sits close; and her colour and markings so resemble her surroundings that she is seldom noticed by a passer-by. Her young can run as soon as they are hatched.

I have witnessed a strange device that the partridge has of escaping its foes in the Winter.

I was standing beside a church which was built near such a wood lot as we are considering. The snow lay deep on the ground, and was drifted against the edifice. Suddenly a pair of partridges whirled rapidly round the gable of the building. They were unaware of my presence till they came upon me. I could have touched them but they dived with startling rapidity into the drift beside me, scattering the light snow all around as they passed in, and so completely closing up their passage way that I could not tell the exact spot where they had entered, though it was not more than three yards from me.

Representatives of the insect world are on the wing, or sunning themselves on the foliage. There is *Polygonia faunus*, Edwards, the most beautiful of our Graptadæ. Notice the rich mottling of its under side. There, too, is *Basilarchia arthemis*, one of the finest of our butterflies. The dark

purple of its upper surface is banded with pure white and adorned with orange spots and blue crescents. The larvæ of these lovely butterflies feed upon the elm, willow, etc., and they do little, if any, harm.

But we must not dwell upon the inoffensive insects, however beautiful. Let me draw your attention for a moment to creatures that work in darkness, to the injury of the trees. Some of these belong to the HYMENOPTERA: *Tremex columba*, Drury (Fig. 41); *Uroceros albicornis*, Fabricius; *U. cyaneus*, Fabricius; *U. flavicornis*, Fabricius. They are large, handsome, but formidable looking flies. Their larvæ tunnel in various trees and do much damage. Fortunately their number are kept down by several species of even more dangerous-looking ichneumons: *Thalessa atrata*, Fab.; *T. lunator*, Fab.; *T. nortoni*, Cresson, &c. The larvæ of these follow up the larvæ of the others and devour them. Many a tragedy, that we know not of, is done in the darkness.

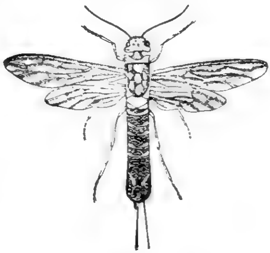

Fig. 41. Pigeon-tremex—the Horn-tail borer—(*Tremex Columba.*)

The larvæ of many beetles are borers. I dare say that this log on which we are sitting is bored through and through by the larvæ of *Orthosoma brunneum*, Forster.

We do not greatly wonder that larvæ of some of the four-winged flies, and of some of the beetles should bore in timber; but it does seem remarkable that larvæ of some of our moths should do the same.

Yet the larvæ of *Cossus centerensis*, Lintner, bore in the Balsam Poplar; the larvæ of *Prionoxystus robiniæ*, Peck, bore in the locust; the larvæ of *Prionoxystus Macmurtrei*, G.-M., bore in the oak; the larvæ of *Ægeria apiformis*, Clerck, bore in the willow; the larvæ of *Sesia acerni*, Clemens, bore in the maple; and there are others of like habits.

Turning our attention to the trees again. There is a White Cedar. Cedar is not plentiful on the Eastern Township farms. The man who owns a cedar swamp owns a mine of wealth for Cedar is of great value for shingles. There are, however, extensive tracts of cedar elsewhere. At Grand Metis, a company, called the "Grand Metis Lumber Company" is operating. This firm cuts, I am told, from 150,000 to 200,000 logs per year, out of which they manufacture from 50,000,000 to 65,000,000 shingles in the same period. They ship their output by rail to the New England States. One thousand feet, log measure, will yield about 8,000 shingles (32 bundles of 250 shingles each).

First quality shingles are worth from $4.00 to $4.35 per thousand, delivered at New England points. The duty at the border is 30 cents per thousand.

Cedar, to the lumber firms, is about twice as remunerative as spruce.

The White Birch is another valuable tree. The spools which are of use all over the world are made from its wood.

There are districts in which the White Birch (or "Bouleau," as the French call it) grows abundantly. Such a tract is that from Matane to Cap Chat, on the south coast of the St. Lawrence.

The firm operating in that part of the country is James Richardson & Co.

The timber is sawn into strips 1½ to 6 feet long, 2 inches broad, 2 inches deep. The white wood only is used; the heart wood is laid aside for fuel.

The strips of white wood are tied up in bundles, and shipped from Matane, in Norwegian sailing vessels, to Coats & Co., of Glasgow, who with some associated companies have the spool business entirely in their own hands.

The vessels that convey the spool wood to Scotland, when taking in cargo at Matane lie half a mile, or more, from the shore; and the lumber is carried out to them in scows, open boats and schooners. 3,000,000 feet of spool-wood board measure is exported from the Matane district every year.

Observe that small tree with blossoms resembling hops. It is the Hop Hornbeam or Iron Wood (*Ostrua virginica*). Young trees of this kind and young ash trees furnish the farmer with levers firm and good.

Speaking of levers, this incident came under my observation some years ago:—A farmer made a "Bee" for the purpose of drawing sawlogs to the mill. The neighbours came. On entering the wood, those who were not already supplied cut levers for themselves. An emigrant, who had been engaged by one of the men, observing this, cut a lever for himself. The work commenced. The emigrant made a great show of strenuous effort—it was but a show. The man beside him called out, "Lift man, lift!" Then he added, "Let me see your pry." Holding this up, he shouted, "A basswood! A basswood!" A roar of contemptuous laughter followed from the other men. The immigrant stood amazed. In his ignorance of the nature of the wood, he did not know that his pretentious ineffectiveness had been exposed.

Even the bushes around us are worthy of attention. There is the Moosewood, also called Wicopy (*Dirca palustris*). You cannot break a stick of it—the rind is too tough; but the wood, when peeled, is remarkably brittle. The farmers, when short of string, use strips of the bark, which is pliant as well as tough, for tying up the mouths of their sacks of grain, etc.

As we make for home, let us consider the condition of things in some parts of the country.

It is grievous to see the way in which farms are often mismanaged. Men with little means and less judgment, buy farms "on time" at more than their value. To meet their payments these men have to part with everything that will bring money. They have not wherewithal to purchase sufficient stock; and they sell the hay off their land year after year, impoverishing the farms more and more. They cut down their woods, and sell the maple for fuel, and the spruce for pulp wood. Where there are chemical works within reach the denudation of the land goes on rapidly, for hard wood is in demand for the distillation of wood alcohol, and other wood for feeding the furnaces in the work. By and bye the farm will be so unproductive that the owner will have to leave it.

According to the latest reports there are in Rhode Island 228 abandoned farms. In Massachusetts the abandoned and waste land amounts to one-tenth the total area of the state. But wealthy and intelligent men are now buying up the abandoned tracts and planting them with trees. One of them this year has planted 63 acres with white pine, and intends to plant 50 acres per year for the next ten years. See the "Richford Gazette" for October 9th, 1908.

Our own people should seize every suitable opportunity for tree-planting. They should put in trees for wind-breaks to their homesteads and orchards, shade trees for their roadsides, ornamental trees for their lawns and parks, young fruit trees to supply gaps in their orchards, young maples to keep up their sugar woods, useful trees in every waste spot.

In conclusion I would impress upon your minds the advice of an old North Countryman:

"Be aye stickin' in a tree.
'Twill be upwards creepin'
While ye are a-sleepin'.

LIFE HISTORY OF EUCHÆTIAS OREGONENSIS (Stretch).

BY HENRY H. LYMAN, M.A., MONTREAL.

On 10th July, 1898, I had a day's collecting in High Park on the western outskirts of Toronto.

Neonympha Canthus was abundant in the moist hollows and *Satyrus Nephele* was also flying. *Thecla Edwardsii* and *Lycaena Scudderi* were common, the former on *Ceanothus Americanus* a low spreading shrub with white flowers, and the latter coquetting with the blue flowers of the harebell. *Thecla Acadica* was also flying with *Edwardsii* and *L. Neglecta*, *P. Troilus*, much worn, *P. Nycteis*, *Plusia Simplex*, brown form, were also taken while *L. Arthemis*, *P. Oleracea*, presumably of second brood, were seen, as well as *D. Archippus* from the south leisurely ovipositing.

While collecting the Theclas a white moth came flying around the same plant and was taken. I saw it was a species of Euchætias new to me and as it was a female I kept it alive to secure eggs if possible. I subsequently learned that it was *Oregonensis*, but it had lost all the pale drab tone of the primaries and was practically white.

Eggs, round, gum-drop shape, about as high as the diameter, which is .83 mm., shiny, but showing minute facets under a 2-inch power. Colour, honey-yellow when laid, turning dark lead colour just before hatching.

Began hatching 18th July, and all but one were out on 19th. Egg period about 8 days.

Young larva, length including forked tail 2.33 mm., the forked tail being .17 mm. This forked tail seemed marked under the microscope, but when larva was examined with ordinary pocket magnifier on 21st, after it had fed the forking seemed less conspicuous.

Head, rounded above, brown, darker on upper lobes, the lower part and median suture pale, with a few short hairs. Body after feeding green, yellowish-brown about warts which are dark brown or black. Setæ mostly long, black; cervical shield brown. Wart III. on abdominal segments has two setæ. The setæ on 4th segment are larger than on middle segments and project forward. On 5th segment the upper setæ are nearly twice as long as on middle segments. On 11th to 13th segments they are also longer than on the middle ones, those on 12th and 13th being longer than on the 11th. Feet, dark brown, claspers greenish.

For a wonder the specimen described kept quite still while its description was being taken. The larvæ on hatching were placed on *Asclepias*, but did not fancy it. Mr. Winn suggested Dogbane (*Apocynum Androsæmifolium*) which was then supplied and accepted by the larvæ as satisfactory.

On 22nd July they began passing first moult, the length after the moult being 4.7 mm.

As I was leaving town early in the morning of Saturday, the 23rd to spend Sunday at Lake Memphremagog, I merely took the length expecting to be able to take the rest of the description on my return, but on the 26th recorded in my note book that the second moult had already been passed and made the following description:

Stage III., after second moult. Length 8.6 mm. Head, rather small, rounded above, yellow, the ocelli, brown.

Body, rather plump, greenish yellow, with a green dorsal stripe, more conspicuous on the abdominal segments. Hairs spreading, a few longer than the others on some of the anterior and posterior segments, yellowish. The lateral warts seem to be placed in depressions. Feet and claspers, yellowish.

These larvæ matured very rapidly and on 28th the third moult was being passed.

Stage IV., after third moult. Length before feeding about the same as when last taken.

Head, yellow, mouth parts brownish. Body greenish yellow, the pulsating vessicle showing as a green line. Hairs, long and silky, overhanging the head and anal extremity, light yellowish. Anal claspers, rather small and spreading. Feet and claspers, pale yellowish.

The caterpillar under observation which had just passed the moult stood on its central abdominal claspers and raised both extremities, back to back, brushing them together to adjust the hairs. This it did repeatedly and with so much energy that it lost its hold and fell off the leaf.

On 31st July all but two had passed the fourth moult.

Stage V., after fourth moult. Length, 12.5 to 14 mm. Head, yellow, with tinge of orange, ocelli dark brown or black. Except when feeding or in motion the head is concealed by the hairs of the second and third segments which overhang it. Body, pale greenish, the spreading hairs greenish yellow. There are a number of long hairs on the segment projecting forward over the head, and a few on the third and fourth segments which stand straight up or project slightly forward. These hairs are from three to four times as long as the other hairs. There are also a number of similar long hairs on the 11th, 12th and 13th segments which slope towards the rear.

While I was describing these, at least about a half of them roused themselves and began running about, especially around the rim of the jar, stopping every few seconds and sounding with their feet, raising the thoracic segments and striking a number of times and then going on again. They sometimes crawled part way down the outside of the jar, but generally crawled up again, not showing any disposition to go far from home. Two, however, crawled down to the table, but one of these crawled upon the tin cover of the jar and rested there.

On 1st August two were found to have passed the fifth moult, but no change in size was apparent.

As I was leaving that evening for a brief trip to Tadousac on the lower St. Lawrence I had no time to make any detailed description of Stage VI.

On 5th August the larvæ were passing the sixth and last moult and changing their appearance considerably, but also showing a good deal of variation. Some were mouse-gray all but the head which was still honey-yellow, while others were gray as to the skin, but with yellowish hairs and some had yellowish hairs with a few mouse-gray ones mixed in.

These larvæ were perfectly healthy up to the time of my leaving Tadousac for home on the evening of 7th August. They had been perfectly

easy to rear, developed rapidly and none had been lost, but I doubtless made the mistake of not separating them sufficiently as they approached maturity for on my arrival home on the morning of 9th August I found that a choleraic disease had broken out among them and several were dead. I immediately separated them into a number of jars which I had washed with a disinfecting solution of permanganate of potash, putting those that seemed quite healthy by themselves and those under suspicion by themselves.

On 12th August one of those under suspicion spun a rather flimsy gray cocoon weaving in the hairs of its body, but by 21st August all the others had died in spite of all the care that was lavished upon them. Afterwards I found that the one which had spun its cocoon had not had sufficient vitality to pupate.

I thus succeeded in working out the life history of the species, though my cabinet was not enriched with any bred specimens.

Diameter of larval faces of the first six stages were .41, .58, .80, 1.12, 1.38, 1.67 mm.

DR. JAMES FLETCHER.

It is with the most profound regret that we record the death of our very dear friend, Dr. James Fletcher, which occurred on Sunday morning, November 8th. For the last two years his health had not been entirely satisfactory and for more than a twelve month he had been troubled more or less with an internal hemorrhage which caused him much inconvenience and discomfort at times, but which he did not regard as particularly serious. His cheery habit of mind caused him to treat lightly symptoms which would in most cases have excited much alarm. In the middle of September he went out to British Columbia on his annual visit and was absent from home for about six weeks. On his return his colleagues noticed that he had not benefited as much as usual by the trip, and that his appearance was by no means robust. But with characteristic energy he at once set to work to make the arrangements for the Annual Meeting of the Entomological Society of Canada, which he desired should be one of the most successful in its history. As President for the second year in succession, he expected to retire from office, but fully counted upon being present at Guelph and occupying the chair at the various sessions which were held on November the 5th and 6th. During the preceding week, however, he wrote saying that he was going to Montreal to consult a specialist, and might after all be unable to attend. He went down on Saturday the 31st of October, and was at once sent to the Royal Victoria Hospital, there to prepare for an operation. To the writer he sent a letter the following day expressing his great disappointment at being laid up and prevented from coming to Guelph, but full of confidence in the wonderful power of modern surgery and with apparently no fears as to the result. The operation took place on the following Saturday, but he failed, owing to his weak condition, to rally from it and the next morning he died. The operation revealed that he had been suffering for some time from a malignant tumour which had sapped his vitality and would very soon in any case have brought his life to a close. Up to the end he was cheerful and uncomplaining, free from despondency or anxiety about himself, and full of the happy optimism which had always been one of his charming characteristics.

Few men ever made so many loving friends in all walks of life; every one who came to know him could not fail to become warmly attached to him. There are many sad hearts grieving at his loss all over the Dominion of Canada and many, too, in widely scattered places in the United States. Old and young, rich and poor, learned or ignorant, children and their elders, it made no difference—he had a kindly word for each one and most can treasure in their memories a kindly deed as well. When he addressed a meeting he captivated his audience at once and when he joined an excursion of nature students all were eager to be with him, and learn from him some of the secrets of the woods and fields that he knew so well. We shall not see his like again, but we may all feel that it was good for us to have known him—his memory will long live in our hearts—his noble words and generous deeds will be happy recollections for many a year to come.

Dr. James Fletcher was born at Ashe in the County of Kent, England, on March 28th, 1852. He was educated at King's School, Rochester, and came to Canada in 1874 to fill the position of a clerk in the Bank of British North America. Finding the work uncongenial after two years, he gave it up and became an assistant in the Library of Parliament at Ottawa. All his spare time he devoted to Botany and Entomology and became as years went on a recognized authority in each of thse branches of natural science. This led to his appointment as honorary Dominion Entomologist and Botanist and a year or two later to his taking up the work of these departments at the newly established experimental farm. This was in 1887 and for twenty-one years he has been a highly valued assistant to Dr. Saunders, the director, and long since became known throughout North America as one of the ablest scientific men of the day in his special departments.

In 1878 he became a member of the Council of the Entomological Society of Ontario, and every year since he has been elected to hold some office in it, being four times Vice-President, and President for three years, from 1886 to 1888 and again from 1906 to the time of his death, when he had just been re-elected for another year. His first contribution to the Society's publications was an article on Canadian Buprestidæ, which was published in the Annual Report for 1878, and his first contribution to "The Canadian Entomologist" appeared in January, 1880. During all the years that have followed no volume of either publication has been issued without some valuable articles from his pen.

In 1879 he was one of the originators of the Ottawa Field Naturalists' Club, the most successful society of the kind in the Dominion, and more recently he suggested, and by his energy and influence accomplished, the formation of the important Association of Economic Entomologists of North America, of which he was elected President in 1892. He was also one of the original Fellows of the recently formed Entomological Society of America, and was First Vice-President last year. In 1886 he became a Fellow of the Linnæan Society, of London, and in 1896 he received the degree of LL.D., *Honoris causa*, from Queen's University.

In 1885 he was elected a Fellow of the Royal Society of Canada; in 1895 he became President of Section IV., which is devoted to Geological and Biological Sciences. For many years he was Honorary Treasurer of the Society, and for the last two years Honorary Secretary. To the transactions of the Royal Society he contributed the following papers: Presidential Address, 1895, on Practical Entomology; Recent Additions to the list of Injurious Insects of Canada, 1899; The Value of Nature Study in Education, 1901; Descriptions of some new Species and Varieties of Canadian Butterflies, 1903; Notes on the Preparatory Stages of some Species of Canadian Lepidoptera, 1907.

A list of his contributions to scientific and agricultural journals would occupy many pages, if such a list could be completely carried out. His most valuable publications were his annual reports on the work of his department at the Central Experimental Farm and the Bulletins in connection with it, in which he gave accurate detailed descriptions of a large number of injurious insects, and also his papers in the Annual Reports to the Legislature of the Entomological Society of Ontario. Two years ago he completed an admirable work on the Farm Weeds of Canada, containing descriptions of all the most important weeds that are a trouble to agriculturists throughout the Dominion; a handsome quarto volume illustrated with 56 beautiful coloured plates.

Not only with his pen, however, did he perform useful work, but with his voice as well. He was in great demand as a public speaker at Agricultural, Horticultural, and Fruit-growers' conventions, meetings of Farmers' Institutes and other gatherings. On these occasions he at once secured the attention of his audience and charmed them with his graceful language and lively humour. No one else, indeed, has done so much for Canada in instructing the people in a practical knowledge of their worst insect foes and the best methods of dealing with them. His work has thus been of vast importance not only to those directly interested in the products of the soil, but indirectly to all the dwellers within the domains of this wide Dominion.

Though so fully occupied with scientific work he yet found time for other things. He was one of the most efficient members of St. Luke's Hospital board; for many years lay-reader and superintendent of the Sunday school in Holy Trinity Church, Archville, a suburb of Ottawa; and an active member of the St. Andrew's Brotherhood. His religious life as a devout son of the Church of England was known perhaps to but few amongst his intimate friends, though manifested in many ways through his goodness of heart; he lived and died an earnest, God-fearing man, devout and upright, filled with unobtrusive piety, a sincere Christian indeed "in whom was no guile."

While we deplore the loss that we all feel we have individually sustained, we desire to express to his sorrowing family, Mrs. Fletcher and her two daughters, the deepest sympathy with them in their sad bereavement. To them the loss is beyond all words, but it may afford them a ray of comfort to know that he whom now they mourn was so widely beloved, admired and respected and that so many friends share in their grief and are filled with sorrow for him who is gone.

C. J. S. Bethune.

Dr. L. O. Howard, Chief of the Bureau of Entomology in the Department of Agriculture at Washington, a friend of many years standing, writes as follows:

"Dr. Fletcher's services to his country were very great. He had a wonderful grasp of a very broad field in Entomology, and was one of the best-informed men of his time on the intricate and manifold aspects of economic Entomology. His reports were sound and practical, and as a public speaker before assemblages of agriculturists and horticulturists he was unexcelled. His address years ago before the National Geographic Society in Washington, on the Canadian Northwest, was one of the most perfect lectures I ever

heard. He was known, admired and loved all through the States. In fact, I have never known a man who had so many absolutely devoted friends as Dr. Fletcher. His energy, his enthusiasm, his absorbing interest in everything that lives and grows, his warm heart, his cheeriness, his perfect lack of even a suspicion of egotism, attracted every one who knew him, and bound them to him in friendship, and even love, forever. Here in Washington among the Entomologists and others there are many sad hearts to-day."

DR. WILLIAM H. ASHMEAD.

On the 17th of October Dr. William Ashmead died in Washington, D.C., aged 53 years. For more than a year he was in such an unsatisfactory state of health that his recovery appeared impossible and it was therefore no surprise to learn that the end had at last arrived. His break down in the midst of a career of scientific usefulness was evidently brought about by overwork; he devoted himself with such intensity to the study of the Hymenoptera and the publication of the results that he gave himself no rest and literally wore himself out, to the grief and distress of his family and many friends.

For close upon thirty years he was a constant contributor to the pages of "The Canadian Entomologist," his first articles on insects affecting the orange, having appeared in 1879. At that time he lived in Jacksonville, Florida, where he was engaged in the publishing business, which included the issue of a daily paper and a weekly agricultural journal. He was naturally much interested in the production of oranges and his attention thus became drawn to the insects injuring the trees and fruit and those parasitic forms that somewhat keep them in check. His work was so thorough that he was made a field Entomologist for the United States Department of Agriculture in 1887, and began his career as a professional Entomologist.

In 1890 he went to Germany and studied for some time in Berlin, thus becoming qualified for the performance of scientific work of a high character. In July, 1897, he was appointed a Curator of the Department of Insects in the United States National Museum at Washington, and continued to hold the position till incapacitated by illness.

In October, 1904, he was elected an "Honorary Member of the Entomological Society of Ontario in recognition of his eminence in the science and the valuable contributions that he so constantly made to the pages of the "Canadian Entomologist." His studies were devoted to the Hymenoptera, and he published many systematic papers on various super-families in the order and described a large number of genera and species. His work was of such a high character that it is regarded as authoritative and has attracted the attention of the leading Entomologist of both Europe and America. One of his completed works is his Monograph of the Proctotrypidæ, a volume of nearly 500 pages published in 1893. Most of his papers are to be found in the Transactions of the American Entomological Society of Philadelphia and in the Canadian Entomologist.

He received the honourary degree of Doctor of Science from the Western University of Pennsylvania and was the recipient of many distinctions from various Entomological Societies. Personally he was esteemed and beloved by all who knew him and there are many who now deplore his loss.

C. J. S. B.

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Fortieth Annual Report

OF THE

Entomological Society

OF ONTARIO

1909

Published by the Ontario Department of Agriculture, Toronto.

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29-37 Richmond Street West,
TORONTO

To the Honourable John Morison Gibson, K.C., LL.D., etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

The undersigned begs to present herewith for the consideration of your Honour the Report of the Entomological Society of Ontario for 1909.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1910.

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FORTIETH ANNUAL REPORT

OF THE

Entomological Society of Ontario

1909.

To the Honourable James S. Duff, Minister of Agriculture.

SIR,—I have the honour to present herewith the Fortieth Annual Report of the Entomological Society of Ontario, which contains the proceedings of the forty-sixth annual meeting of the Society, which was held at the Agricultural College, Guelph, on the 4th and 5th November, 1909. The report includes the papers read and the reports submitted by the various officers and branches of the Society.

"The Canadian Entomologist," the monthly organ of the Society, has been regularly issued during the past year, and has now completed its forty-first volume, which has maintained the high scientific standard of its long series of predecessors.

I have the honour to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Editor.

Ontario Agricultural College,
Guelph.

Entomological Society of Ontario.

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Dashwood-Jones, W. H......New Westminster.
Day, G. O...................Duncan's Stn.
Draper, R. ....Hillcrest.
Elliott, B. R. ....Victoria.
Grassham, R. T............Keithly Cr'k.
Hanham, A. W..............Duncan's Stn.
Harvey, R. V...............Victoria.
Keen, Rev. J. H............Metlakatla.
Luscombe, P................Cowichan Bay.
Marrion, H. ....Vancouver.
Mason, J., G.T.P............Copper River.
Reed, E. Baynes............Victoria.
Sherman, R. S..............Vancouver.
Skinner, E. M..............Duncan's St'n.
Taylor, Rev. G. W..........Departure Bay, Nanaimo.
Van Steenweyk, Miss........Vancouver.
Venables, E. P..............Vernon.
Wilmot, E. S............... "
Wilson, T. ....Vancouver.

Manitoba.

Criddle, Norman ....Aweme.
Heath, E. F.................Cartwright.
Hunter, Rev. A. J...........Teulon.
Wallis, J. B.................Winnipeg.

Nova Scotia.

Chase, W., Jr...............**Wolfville.**
Hervey, C. L. G............**Round Hill.**
Mackay, Dr. A. H...........**Halifax.**
Payne, H. G.................**Granville Ferry.**
Russell, John ....**Digby.**

Saskatchewan.

Androchowicz ....**Humboldt.**
Willing, T. N...............**Regina.**

Honorary Members.

Cockerell, Prof. T. D. A.....**Boulder, Col.**
Cresson, Ezra T............**Philadelphia, Pa.**
Howard, Dr. L. O...........**Washington, D.C.**
Scudder, Dr. S. H.......... **Cambridge, Mass.**
Smith, Prof. J. B...........**New Brunswick, N.J.**
Uhler, P. R.................**Baltimore, Md.**
Webster, F. M..............**Washington, D.C.**
Wickham, Prof. H. F........**Iowa City, Iowa.**

Life Member.

Saunders, Dr. William......**Ottawa.**
Director of the Experimental Farms of the Dominion.

Entomological Society of Ontario.

ANNUAL MEETING.

The forty-sixth annual meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, November 4th and 5th. During the day meetings the chair was taken by the President, Mr. Tennyson D. Jarvis, and at the evening session by Dr. Bethune. Amongst those present were Messrs. H. H. Lyman and A. F. Winn, Montreal; Dr. C. G. Hewitt and Mr. Arthur Gibson, Central Experimental Farm, Ottawa; Mr. John D. Evans, Trenton; Mr. F. J. A. Morris, Trinity College School, Port Hope; Dr. E. M. Walker and Messrs. C. W. Nash and J. B. Williams, Toronto; Mr. R. C. Treherne, Grimsby; President Creelman, Profs. C. A. Zavitz, R. Harcourt, S. B. McCready, C. J. S. Bethune, Messrs. Jarvis, Howitt, Caesar, Eastham, Crow, Klinck, of the staff, and a large number of the students of the Ontario Agricultural College and the Macdonald Institute, Guelph.

Letters expressing regret at their inability to attend were received from Prof. C. C. James, Deputy Minister of Agriculture for Ontario; Dr. William Saunders, Director of the Dominion Experimental Farms, Ottawa; Rev. Dr. Fyles, Hull, P.Q.; Messrs. Paul Hahn and A. Cosens, Toronto; G. Chagnon, Montreal; C. E. Grant, Orillia; W. E. Saunders and J F. Calvert, London; R. S. Hamilton, Galt; Prof. W. Lochead and Mr. J. M. Swaine, Macdonald College, P.Q., and others.

A business meeting of the Council was held in the Biological Building, at which their report was drawn up and various matters discussed. On motion it was decided to contribute the sum of fifty dollars to the fund for the erection of a memorial drinking fountain to the late Dr. James Fletcher at the Experimental Farm, Ottawa.

In the afternoon the Society met at 2 o'clock in the Biological Lecture room, where there was a goodly attendance of members and students. The first order of proceedings was the reading of the reports of the Directors on the noteworthy insects of the year in their respective districts. Owing to various circumstances, none were received from Mr. C. E. Grant, of Orillia, representing Division No. 2, nor from Mr. R. S. Hamilton, Galt, of Division No. 6.

REPORTS ON INSECTS OF THE YEAR.

Division No. 1.—Ottawa District. By Arthur Gibson, Central Experimental Farm, Ottawa.

The season of 1909 in the Ottawa District, although cool and late in spring, was an excellent one for growth of all kinds. The rainfall during the whole season was rather above normal, and there was, comparatively speaking, but little hot weather, and this not until the middle of August. Injurious insects, as a whole, were not so troublesome as they were in 1908.

The following notes probably cover those insects which were most complained of in the District during the past season.

ATTACKING FIELD CROPS.

The Hessian Fly (*Mayetiola destructor,* Say.) which was troublesome near Ottawa in 1908, was not reported as present in 1909. On the Central Experimental Farm, where it occurred last year, no trace of its work could be detected this year.

Grasshoppers were decidedly destructive in many localities near Ottawa, particularly in places where the soil is light. On June 21st I received a report that these insects were causing much anxiety to farmers near Buckingham, Que., about 23 miles from Ottawa. It was stated that they were present in that district in "countless millions." Up the Gatineau River grasshoppers were enormously abundant, and many complaints were made concerning their ravages. On July 29th I drove from Maniwaki to Baskatong, Que., a distance of about 40 miles, and saw the insects in great swarms. Oats, which are largely grown in the Gatineau country, were much damaged, also timothy; the crops in some fields being entirely eaten. At Baskatong I visited a large field of turnips, the tops of many of which had been completely eaten, and what remained was rapidly being devoured by the grasshoppers. At Castor, Que., which is about half way between Baskatong and Maniwaki, one farmer had sown turnips twice and had lost both crops. On July 30, the grasshoppers were working in his oat and wheat fields. I was much amused at a method which was being adopted to save the crop of turnips at Baskatong. A s mall boy was kept walking up and down the rows of turnips with a branch in his hand, with which he endeavoured to drive off the grasshoppers. Of course, almost as soon as he had passed, the insects immediately swarmed back to the plants and continued their work of destruction. The species which was responsible for the damage was the Lesser Migratory Locust, *Melanoplus atlanis*, Riley. I advised them to try the Criddle mixture, which had given such remarkable results in Manitoba. The following quotation is from a letter I recently received from Mr. Criddle, of Treesbank, Man., who devised this mixture: "There has been another rather bad outbreak of locusts here, which has necessitated several applications of the Criddle mixture. The result has been entirely satisfactory, the mixture having undoubtedly prevented much damage. I was beginning to be afraid that I had over-estimated the value of horse droppings as an attraction, but I am glad to find that such is not the case."

The Grain Aphis (*Macrosiphum granaria,* Kirby) was present in large numbers in the Ottawa District. In the Gatineau country I saw many fields, at the end of July, which were infested. Fortunately, the outbreak, as usual, was attended by parasites which greatly reduced the numbers of the plant lice. Some fields of oats, however, at the above date, looked as if they had been much weakened by the attacks of this insect.

The Greater Wheat-stem Maggot (*Meromyza Americana,* Fitch.) was conspicuously present in wheat near Ottawa. Larvæ collected on July 9th were apparently full-grown, being about a quarter of an inch in length. In some experimental wheat plots on the Central Experimental Farm the "silver tops" or "deadheads," as they have been called, were rather abundant, but were not present, however, in sufficient numbers to affect materially the resultant crop. They were especially noticed among wheat of the variety called "Bishop."

The Apple-leaf Hopper (*Empoasca mali,* LeB.) which did so much harm in eastern Ontario in 1908, was again present on potatoes in injurious numbers in the Ottawa district. Its work was supplemented very much this year, however, by the Potato Aphis and the Potato Flea Beetle, particularly the former. On October

6th, I was present in a field when the potatoes were being harvested, and was surprised to see the crop so poor. I was told that the above insects were largely responsible for the small crop. On the 14th of September, when examining some potatoes, I noticed many of the nymphs of the Apple Leaf Hopper, and on the same day in an orchard close by, the adults were flying in thousands around apple trees. On July 14th some of the mature insects were noticed on potatoes on the Experimental Farm. Up to this date I had not heard of any damage in the Ottawa district by this insect.

The Potato Flea Beetle (*Epitrix cucumeris*, Harr.), besides injuring potatoes, as above mentioned, attacked to a very noticeable extent a number of plants of the Wonderberry which were growing a short distance away. The Flea Beetle was not present in the district in such numbers this year as it was in 1908. As a rule it is more numerous in hot dry summers.

Root Maggots were not much complained of in the district during 1909. They were present, of course, as they always are, but as far as I can learn, not much damage has been done by them. On the Experimental Farm, for instance, hardly an onion was destroyed by these larvæ. On September 14th I saw them working to some extent in an experimental row of winter radishes.

Cutworms were present, as usual, in injurious numbers. At Carp, about 20 miles from Ottawa, an outbreak occurred towards the end of June. Mr. Sirett, the resident representative of the Ontario Department of Agriculture, reported the matter to me, but unfortunately specimens of the larvæ were not received. Mr. Sirett thought, however, that the species was the Variegated Cutworm, *Peridroma saucia*, Hbn. Injury was done to field crops, but just what these crops were, I did not hear. About the middle of July the Red-backed Cutworm was present in fair numbers in a large field of mangels on the Experimental Farm. The larvæ on the 15th July were about full-grown. An application of poisoned bran soon stopped any further injury.

The Striped Cucumber Beetle (*Diabrotica vittata*, Fab.) was particularly numerous during the past season. It appeared on some cucumbers in my garden on June 15th, just as the plants were up nicely. On July 3rd I saw many in copulation. At Billings Bridge, near Ottawa, it was particularly reported to be injuring squashes. It also to some extent attacked melons, and was complained of by many of our market gardeners. As this beetle is very active, any application of poison must be frequently renewed. The leaves should be dusted with Paris green mixed with land plaster or lime in the proportion of one pound of the poison to fifty of the diluent, if necessary every second day. Bordeaux mixture is also a useful remedy for this insect as well as for the Cucumber Flea Beetle which often does serious injury.

The Black Blister Beetle (*Epicauta pennsylvanica*, DeG.) appeared suddenly at several places in the district, and did locally noticeable damage, particularly to potatoes and tomatoes. Plants in flower gardens were also attacked, and in some instances the foliage completely eaten. In one garden near Ottawa 100 splendid Clematis plants were defoliated, the beetles appearing on the 23rd June. On June 28, they were present in conspicuous numbers in the Arboretum of the Central Experimental Farm and were attacking plants of the genus Thalictrum, in the perennial border. As is well known, these beetles in their larval form are predaceous on the eggs of grasshoppers, so generally speaking it is not advisable to destroy them with arsenical sprays. They can often be driven from a crop by several boys walking across it and waving from side to side a bough of spruce or other conspicuous branch. As these beetles are easily disturbed they will fly ahead, and on reaching the edge of the crop will disperse and as a rule not return

Attacking Fruit Crops.

The fruit crop in the Ottawa district was on the whole a very fair one. Weather conditions have been excellent for the maturing of fruit. Insects have not been especially destructive, and growers who sprayed their trees regularly were not much troubled.

The Codling Moth (*Carpocapsa pomonella,* L.) did a good deal of damage in unsprayed orchards in Eastern Ontario. The intelligent fruit growers of the district, however, were not troubled to any serious extent by this insect. A friend who lives at Aylmer, Que., about 9 miles from Ottawa, told me that every apple in his garden was wormy. He had, of course, neglected to spray his trees.

Plant lice were the insects which were most abundant in orchards in the district during the past year. The season has been a remarkable one for plant lice of all kinds. Apple and plum trees were badly attacked, and where small trees were infected, serious damage resulted. During the early part of June the plant lice were enormously abundant in orchards near Ottawa, but towards the end of the month it was noticed that important parasites were appearing and doing splendid work in reducing their numbers. When orchard trees become badly infested with plant lice, it is a difficult matter to destroy the insects, on account of the curled up condition of the leaves, making it almost impossible to reach the insects with any contact insecticide. In eastern Canada, fortunately, these insects do not, as a rule, seriously injure apple trees, but in British Columbia, the Apple Aphis is in some years decidedly destructive, and frequent treatment is necessary. The Woolly Aphis of the Apple was fairly prevalent in the Ottawa district during the past season. On September 14th, I saw a number of young apple trees which were much infested.

The Pear-tree Slug (*Eriocampa cerasi,* Peck.) was again noticeably present on plum and cherry. The foliage of some trees examined in September was much eaten by the slimy dark coloured slugs of this sawfly. The insect is one which is easily controlled by spraying with any of the arsenical poisons.

The Currant Worm (*Pteronus ribesii,* Scop.) was complained of by growers of currants. The second brood of larvæ were very numerous in a large patch of red and white currants near Ottawa on July 12. They first appeared a few days before this date, and were quickly stripping the bushes of their foliage. The first brood of this insect, which appears when the leaves are attaining full size, are easily controlled by Paris green or arsenate of lead, but for the second brood, which appears just as the fruit is ripening, white hellebore is recommended, either dusted upon the bushes, or applied as a spray, one ounce in two gallons of water. The first brood should be treated thoroughly so as to reduce the numbers of the second brood.

The Currant Aphis (*Myzus ribis,* L.). Almost wherever currants were grown the past season they were attacked by large numbers of this plant louse. In eastern Ontario we received many complaints of the work of this insect. Unfortunately, unless the bushes are sprayed with kerosene emulsion or whale-oil soap, as soon as the aphides appear, and before they cause the leaves to blister and curl, it is difficult to get good results from the work. It is necessary to force the liquid well up beneath the leaves. This can be done by attaching a piece of bent pipe, bearing the nozzle at the end, to the rod of the sprayer.

Attacking Forest and Shade Trees.

Cankerworm larvæ were more abundant in the spring of 1909 than they were in 1908. On the 4th June they were half grown. At Beechwood, just outside of Ottawa, beech trees were badly attacked, the result of their depredations being easily seen. When ornamental trees are attacked by these caterpillars, it is important to apply the arsenical poison while they are small. They can then be easily killed at the ordinary strength used for leaf-eating insects. When they are more than half an inch long they are a good deal more difficult to kill, and consequently much stronger sprays must be used.

The Spiny Elm Caterpillar (*Euvanessa antiopa,* L.) was abundant on elm trees throughout the district. On June 21, larvæ about one and a quarter inches long were noticed. Specimens which were collected had become full grown and changed to chrysalids by July 10. The species is intermittently abundant at Ottawa, and some years it is not an uncommon sight to see small elm and willow trees entirely stripped of their foliage.

Elm trees seemed to be particularly attacked by insects during the past season. The Woolly Elm-leaf Aphid was very abundant and many enquiries were received concerning it. By the middle of June the conspicuous colonies were much noticed. The Cockscomb Gall was also numerous in the district, the leaves of many elm trees being covered with these galls. Near Maniwaki, Que., on July 29, I saw large numbers of the Plum Gall, *Pemphigus ulmifuscus.* The galls were large and on most of the leaves of the infested trees there were at least two and very often three or four galls present.

The Spruce Budworm (*Tortrix fumiferana,* Clemens.) This insect caused much anxiety among the lumbermen of the Ottawa district. Reports were received from the upper Gatineau that some insect was ravaging the spruce and balsam forests, and as a result I was sent up into the infested area to find out the nature of the trouble. The result of this investigation is given in a separate paper which I hope to present shortly. At Ottawa, thousands of the moths were noticed flying around bushes and trees of all kinds on July 20th. They were even abundant all through the city, and on almost any bush or tree being disturbed, many of the moths would fly out from the foliage on which they were resting.

The Larch Sawfly (*Nematus Erichsonii,* Hartgn.) was also very prevalent wherever larches were growing. It was noticed in considerable numbers on some ornamental larches on the Experimental Farm, on July 20, and at this time the larvæ were about full grown. Up the Gatineau River from Ottawa as far north as Baskatong, I noticed all through this area at the end of July the results of the work of this larvæ. Many trees were entirely stripped of their foliage. Along the railway, between Ottawa and Montreal, the defoliation of these handsome trees was also conspicuous.

The work of the Spruce Sawfly was also noticed to some extent north of Maniwaki, and larvæ were found to be full grown on July 30. At this date most of the larvæ had disappeared.

The Bronze Birch Borer (*Agrilus anxius,* Gory.) is seriously injuring birches in the Ottawa district. The result of the work of this insect is easily seen at the Central Experimental Farm, where practically all of the cut-leaved birches are dying. This insect has not been mentioned very much in Canada as yet, but in northern portions of the United States it has done a good deal of damage. The presence of this borer is soon shown by the dying of the tops of the trees. This

is owing to the fact that the insect first attacks the tops, which results in the killing of the upper limbs.

The Fall Webworm (*Hyphantria textor,* Harr.) was again present in conspicuous numbers throughout Carleton County. Larvæ were seen to be just emerging from the eggs at Ottawa on July 8, and a small nest on lilac was observed on July 14, the caterpillars in which were only a day or two old. Full grown larvæ were noticed as late as the 6th October.

Attacking Garden Plants.

The Tarnished Plant Bug (*Lygus pratensis,* L.) was very troublesome in gardens the past season. As is well known, this insect not only does injury by sucking the juices from the leaves, but it also pierces the flowers of many plants, thus destroying them. In September the adults were present in thousands around apple and other trees. As they pass the winter in this state, beneath almost any surface shelter, it is important that all garden rubbish be burned in autumn, so as to reduce the hibernating quarters for this and other kinds of injurious insects.

The Destructive Pea Aphis (*Nectarophora pisi,* Kalt.) was again present in 1909 in the district, on sweet peas in gardens. The first colonies were noticed on July 26. At this date I could not find any winged specimens. The attack, however, was not nearly so severe as the outbreak of 1908. In early September I noticed that the parasite *Megorismus Fletcheri,* Crawford, which was described in the *Canadian Entomologist* last March, from Ottawa material, was present in goodly numbers. From parasitized plant lice collected on September 2nd, I secured a further series of the parasites, the specimens emerging on September 15.

Many plants in gardens were seriously injured during the past season by Red Spider. At the Central Experimental Farm, towards the end of July, Phloxes particularly were seen to be dying from the work of this mite. Few garden plants are free from its attack, and as these creatures are so small, their work is generally unnoticed until a good deal of harm has been done. Flowers of sulphur are useful in destroying Red Spider and may be applied in the proportion of one ounce to every gallon of water. As the mites occur chiefly on the underside of the leaves, the spray should be forced up from beneath so as to reach them.

The interesting and rare little Tortrix (*Sparganothis flavibasana,* Fern.) was again rather destructive on a few bushes of Lonicera of the Caprifolium group at the Central Experimental Farm. This is the third year in succession that this insect has appeared on the same bushes. This year the larvæ were mature on June 15.

Division No. 3.—Toronto District. By J. B. Williams.

The Tussock Moth has been, as usual, quite plentiful on many of the shade trees in the city streets.

At the beginning of the summer the Park Commissioner had many of the trees sprayed with arsenate of lead, and later on, towards the fall, several gangs of men were employed to collect the cocoons; but the city appropriation was not sufficient to do the work thoroughly, and as a further grant was refused, the work of collecting the cocoons has come to an end for the present year, just at the time when it might be most successfully pursued.

Early in the summer one of the Park Commissioner's men brought me a sample of Elm bark covered with a scale that was doing much damage to several

trees. I sent it to Mr. Gibson at Ottawa, and he determined it as the Woolly Elm-Bark Aphid (*Schizoneura Rileyi*). They have treated some of the infested trees with whale oil, as Mr. Gibson recommended, and found the results satisfactory.

The Aphid seems, at first, to have been confined to small trees; but Mr. Cameron, the Park Commissioner's assistant, says that it has also begun to attack the small branches of the larger Elm trees, and he fears that it will give them a good deal of trouble before it is eradicated.

Prof. Ramsay Wright had during this summer a good many of his dahlias injured by a bug, which pierces the plant just below the flower bud, and so spoils the blossom. He brought a specimen down to the Museum, but it was mislaid somewhere so that I cannot give the name of the species.

I asked another gentleman, who grows dahlias in the west end of Toronto, if his plants had been injured in this way. He replied that he had not seen any bugs on them, but his dahlias had been a failure this year. Perhaps the bugs may have done some of the mischief without being detected in it.

Division No. 4.—East Toronto District. By C. W. Nash, Toronto.

The summer of 1909 was remarkable for the dearth of insect life in this neighborhood. Even such butterflies as the Cabbage White, Clouded Yellow and Monarch were remarkably scarce and little or no damage was done by the larvæ of the Cabbage butterfly in the large market gardens of East York. The Monarch (*Anosia archippus*), which usually appears early in June was not seen until the first week in July. From that time to early September, when the southward flight takes place, only an occasional specimen was visible. No great host of these insects passed from east to west when migrating as in former years, so that if they do not breed in the south this winter it would seem probable that the species would be very rare in Canada next summer.

Papaipema cataphracta, the larvæ of which, by boring into the stems of plants, have during the last few years done much mischief in flower and vegetable gardens, were not noticed at all this season nor did I find *P. purpurifascia* in the roots of Aquilegias.

It would be interesting to know the cause of the almost total disappearance of *Cosmopepla carnifex.* For some years this insect increased yearly with astonishing rapidity, reaching its maximum in 1907, when the stems of all the Aquilegias, Penstemons and some few other plants grown near here were literally covered with them. In 1908 their numbers were greatly reduced and this last summer I only saw one specimen. There were no evidences of parasites having attacked them. It seems probable, therefore, that weather conditions of last winter were unfavourable and that they perished while hibernating.

The larvæ of the Tussock Moth though extensively parasitized in 1908 were about as abundant as usual on the shade trees of Toronto.

Various matters referred to in the Directors' Reports were discussed by Messrs. Caesar, Treherne, Hewitt, Bethune, Jarvis, Tothill, Nash, Gibson and others. The Woolly Aphis was stated to be rarely found on the roots of apple trees in the Niagara district; it hibernates as a stem-mother in the crevices of bark, and early in spring new colonies are produced. It was reported that in many parts of Ontario, where grasshoppers were so abundant this year, the Criddle mixture was found to

be entirely effective, though in one or two localities complaint was made that the grasshoppers would not touch it. This failure may have been caused by some defect in making the mixture or in the mode of application. In Manitoba this year it has proved to be an excellent remedy.

The Tussock Moth was said to be on the increase in country districts, though largely kept in check by its parasitic enemies. In Toronto the methods employed for its control were much criticized; spraying was done towards the end of July when a large proportion of the caterpillars had ceased feeding; those in charge of the operation had so little experience that they used nozzles that were too coarse, and allowed the pavement and roadway to receive more of the arsenicals than the trees. Subsequently the gathering of cocoons was begun much too soon and then the appropriation was exhausted and further supplies refused when this part of the work might have been performed most effectively.

OBSERVATIONS ON A FEW INSECTS OF THE SEASON.

By Lawson Caesar, Ontario Agricultural College, Guelph.

A year ago last June, when in the vicinity of Niagara-on-the-Lake, I happened to notice a number of white pine trees that seemed to me to have an abnormally large number of dead twigs. On investigation it seemed evident that some sort of borer had been the cause of their death as every twig had a longitudinal hole in the wood and a considerable amount of castings at the entrance. No insects, however, were found in the tunnels or on any of the twigs examined. On the 21st of June of the present year I was in the same district and again examined the same trees. Once more it was clear that borers had been at work. After examining as many twigs as time permitted four specimens of beetles were found in the tunnels. Two of these belonged to one species and the other two to another, but they were all apparently Scolytids. The larger species was not more than about half the size of the Shot-hole Borer (*Scolytus rugulosus*), and the smaller species was only half the size of the larger.

Not having seen this injury elsewhere I thought that it might be the work of some dangerous pest that had just crossed the border and might later on spread through our pine forests. Accordingly I sent specimens of the injured twigs to Dr. Hopkins, of Washington, who has charge of Forest Insect investigations. No beetles were sent with the twigs because I supposed he would be perfectly familiar with their work and could tell me the cause without them. His letter is as follows:

"I have your letter of the 22nd. instant and the specimen of white pine twig that has been injured by a beetle. I examined the specimen and find the work of the beetle, but to my great disappointment no insect could be found. This is a most interesting example of injury, differing from anything I have seen in the East, although I have seen something like it on the Pacific Coast and in the Rocky Mountain region. Therefore I wish you would send a good supply of infested twigs in order that I may be sure to get the beetle. It is evidently a scolytid, but without specimens it cannot be identified. The blighted appearance of the twig is similar to that which was very prevalent throughout northern New England last summer, but in our quite extensive investigations, in which many different causes were found for the dying of the twigs, we did not find evidence of the work of this insect. Therefore the matter is of special interest, and I hope you will send us plenty of specimens without delay, for fear that they may leave the twigs. After we have made a study of the matter we will be very glad to give you further information on the subject."

On receipt of this letter I at once sent all the specimens I had with a request that he keep one of each species and return the other two. A considerable number of twigs were also sent through the kindness of Mr. Alfred Eastham, who happened to be about to visit the infested district. Dr. Hopkins in reply to my note accompanying the specimens said:

"I have your letter of the 1st. inst., and two spcimens of balsam mounts, also two specimens of beetles mounted on card points, and have just now received a bundle of pine twigs collected July 6th, at Niagara-on-the-Lake.

"The beetles in balsam are evidently a species of *Pityophthorus*, but it is impossible to identify them beyond the genus when mounted in this way, and even the genus is uncertain. They are far better for identification mounted dry. The other two specimens on card points represent an undescribed species, evidently of the genus *Conophthorus*, and is allied to a number of species that we have found to be injurious to the living twigs of pine, Douglas fir, etc., in the Western States. I am retaining one of the specimens for further study, and am returning the others to you as requested.

"The specimens of twigs are of unusual interest. A superficial examination seemed to indicate that they represented the common troubles investigated in New England last season, which were found to be due to several causes. A more thorough examination, however, revealed the fact that certain of the twigs with a peculiar grayish appearance were infested with living larvæ, apparently a *Pityophthorus*, and in one dead twig an adult *Pityophthorus* was found. We shall have no trouble in rearing these larvæ to the adult stage, after which we shall be able to identify them and shall write you further.

"One or two forms of the twig blight are also represented by the specimens sent, one associated with a light yellow spot on the twig, which is believed to result from the presence of the nymph of spittle insects, which are often very abundant on pine twigs. Some of the twigs are also thickly infested with *Chermes pinicorticis*, which reduces the vitality of the twigs and trees. These *Chermes* are of special interest, because they have alternate hosts, that is, one or more generations will develop on pine and then migrate to spruce, where they cause galls on the twigs, from which they migrate back to the pine, larch, etc., and there is one form of twig blight which is commonly met with where the white pine and spruce grow together. If, later in the season, you find that twig blight is developing under such conditions, I shall be very glad indeed to have specimens of the twigs."

It is too soon yet to expect any further word from Dr. Hopkins.

I have not had much chance to visit districts where the white pine is found so that I cannot at present say just how far this insect has spread through the province, but since Dr. Hopkin's last letter I have found its work in a pine grove about three miles south of Stoney Creek, and Mr. Jarvis has found it in Peel county near Inglewood.

It is quite clear that if these beetles were to become very abundant they could do enormous damage to our pines. So far they can hardly be said to be very serious, although about five per cent., or possibly more of the twigs have been killed. Trees that were infested last year did not seem any worse infested this year.

It must not be supposed that all the dead twigs seen on pine trees are killed by these insects, because in several districts numerous twigs had died, but on examination there was no evidence of any insect work.

Last year when in Prince Edward County I observed what was to me a new kind of injury on apples. It took the form of small, circular, brown, dead areas about one-quarter of an inch in diameter and one-eighth in depth. The skin over these cavities was always ruptured in the centre. Apples thus damaged were shown last year at our annual meeting, but no one seemed to know the cause. A few weeks after the meeting on looking over Prof. Crandal's excellent bulletin on the Plum Curculio I felt convinced that this insect had done the injury; consequently this autumn I asked Mr. McVannel, the Agricultural Representative at Picton, to see whether he could find any of the Curculios at the work. He discovered two early in September, and on the twenty-fifth of the same month, while in the same county, I found four of the insects at these cavities, two of them having just finished making fresh ones.

The apples worst attacked so far as I could discover by a very limited inspection were Golden Russet, Cranberry Pippin, Ben Davis and Snow. Spy and other varieties with very glossy surfaces seemed to escape. Some of the above mentioned varieties had as many as twenty injuries on a single apple, the majority of them usually being found near the calyx. Orchards that were not cultivated were, as one would naturally expect, much worse damaged than cultivated ones.

This sort of injury is done by the newly emerged beetles before they hide away for the winter and seems to begin about the third week in August and continue to the first week in October or possibly a little later.

It is rather remarkable that there is not considerable loss from this cause in the western counties of Ontario when it is so common in Prince Edward county and, as I have lately been informed, in the counties further east. Prof. Crandal states that in Illinois apples are often severely damaged by these feeding punctures, and Prof. Quaintance says that this sort of injury is especially common in the colder states and districts of North America.

A few interesting cases of parasitism have been observed during the season. For the previous two years the Shot-hole Borer (*Scolytus rugulosus*) has been doing great destruction to cherry, peach and plum trees in the Niagara district. Some fruit-growers lost as high as sixty trees in a single year. Many were afraid that the destruction would increase year by year and endanger the fruit industry. Very fortunately this year the borers have not done nearly so much damage. The reason for this seems to be solely the great increase in parasites. Early in the season, from a small piece of branch only a few inches long, I reared fourteen parasites. In September, while visiting St. Catharines and the surrounding district, numerous parasites could be seen on trees that had been attacked by the borers. A number of these were brought back and proved to be the same as most of those reared in the spring. All the parasites obtained so far are Chalcids, and much the commoner species is, so far as I have been able to determine it, *Chiropachys colon*.

On the trip on which the parasites of the Shot-hole Borer were found in abundance I was also requested to have a look at a maple tree that was said to be covered with some species of scale. On examining it I saw that the insect was the much dreaded Terrapin Scale (*Eulecanium nigrofasciatum*). On first sight I felt sure that the tree would have to be cut down and burned, but on closer evidence it was seen that nearly all the adult scales had been parasitized and there were only a comparatively small number of the living immature scales present. As it was quite clear that the parasites were looking after the scale in a satisfactory manner I informed the owner of the tree that he need not do anything except leave these friends to fight the battle for him.

One regrets to have to report that two of our worst insects have spread to new districts. The San José Scale has been found in one orchard in Prince Edward county and has come safely through the winter on nursery stock planted there last year. Efforts are being made by the provincial authorities to stamp it out before it can become well established and spread.

The other insect is the Railroad Worm. I have received specimens of apples infested by it from Bowmanville and from Cobourg, the latter having arrived only a week ago.

One new pest, the Blackberry Miner (*Scolioneura capitalis*) is becoming very abundant, especially in the Niagara district, and threatens to cause great loss to growers of this fruit unless a remedy can soon be found or parasites come to the rescue.

NESTS OF THE BROWN-TAIL MOTH IN IMPORTATIONS OF FRENCH NURSERY STOCK, 1909.

By Arthur Gibson, Central Experimental Farm, Ottawa.

The inspection work in Canada which was necessary in view of the finding of nests of the Brown-tail Moth in shipments of nursery stock from France, is treated of fully in the annual report of the Division of Entomology and Botany for 1908-1909, which is now in press.

A short statement, however, of the work which was done in the provinces of Ontario and Quebec may be of interest to the members of the Society attending this meeting.

Nests of the Brown-tail Moth containing living larvæ were discovered early last January in New York State on apple, pear and cherry seedlings and quince stocks imported from France. This fact was at once communicated to the Division of Entomology, and a circular giving this information and asking for advice of shipments coming into Canada was at once prepared by the Director, Dr. W. Saunders, and sent out to nurserymen and others who would be interested, as well as to the press generally. On February 5th, after undoubted nests had been found in Ontario, a second circular, giving further information on this threatened invasion of such an injurious insect, was prepared by the Director and the writer, and sent to nurserymen.

The first nest found in such imported nursery stock in Ontario was on a plum seedling on 27th January. This was in the first shipment of stock examined. From this date until May 20th, every shipment of nursery stock coming into the provinces of Ontario and Quebec was examined carefully, either by me or by Mr. Harry Arnold, the Provincial San José Scale Inspector, of Pelham Centre, who had been instructed by Mr. P. W. Hodgetts to assist me on certain dates in this work. Every nurseryman who imported such stock was visited, as well as a number of seedsmen and florists. Thirty different firms or individuals in all were visited, 26 in the Province of Ontario and 4 in the Province of Quebec. A complete list of these and the nature of the stock examined and the number of nests found will be found in the report of the Division above referred to. Many of the nurserymen had to be visited several times, immediately on the arrival of stock.

The examination of this imported stock had, of course, to be made very carefully. Generally speaking, the whitish nests were easily detected, but occasionally small nests would be found, or some which had become broken. The nests mostly occurred between two or three of the twigs or along the main stem of the seedlings, and in size varied from less than half an inch in length and about the same in width, to about nearly three inches in length and over an inch in width.

In the provinces of Ontario and Quebec, 1,503,129 plants were examined. These consisted largely of apple, pear, plum and cherry seedlings, to be used either for grafting or budding. In the province of Ontario, 188 nests of the Brown-tail Moth were found, and in the province of Quebec, 8, making a total of 196. These were found as follows: 100 on pear, 56 on apple, 28 on plum, 5 on quince, 1 on cherry, 2 on rose, 2 on spiræa, 1 on sugar maple and 1 on Prunus pissardi.

We have reason to expect, owing to the way in which the consignments of nursery stock were examined, that every nest of the Brown-tail Moth present was found. No report has come to the Division since this inspection work, of any larvæ of the Brown-tail Moth having escaped from these shipments and established themselves. Nurserymen and others were strongly advised to burn all packing, etc.,

in the cases in which the nursery stock was shipped, as well as the cases. After the trimmings from the fruit seedlings had been burned, as an extra precaution the importers were advised to dip the stock in kerosene emulsion, or a standard miscible oil as was being done in New York State. If the packing, etc., from these cases were not destroyed before spring, it can be readily seen how some of these caterpillars might have got out and established themselves.

In the report of the Division now in press there will also be found a statement of some experiments with hydrocyanic acid gas to kill the larvæ of the Brown-tail Moth. These experiments were conducted in a fumigation box having 128 cubic feet of contents. Varying strengths of gas were tried, from the one used in the federal fumigation houses to destroy the San José Scale, viz., 1 ounce of cyanide of potassium, 1 ounce of sulphuric acid and 3 ounces of water to every 100 cubic feet of air space, exposure 45 minutes, to three times this strength, the exposure being lengthened to 2 hours. In these experiments many of the larvæ had left the nests and were active on the sides of the glass jars, with cheese cloth coverings, in which they had been kept. These experiments, although not very extensive, went to show that fumigation with hydrocyanic acid gas evidently cannot be relied upon as a practical remedy for this insect when in its winter condition. Even when the strength of the gas was three times that used in our federal fumigation houses, and the exposure very much lengthened, only a very small percentage of the larvæ which had left the nests were killed. It would certainly require considerably greater strength and much longer exposure to kill the larvæ when within the nests, and owing to the tough, closely woven nature of these nests the outcome would be very doubtful. In this work of fumigation I was assisted by Mr. Herbert Groh.

THE LARGE LARCH SAWFLY.

(Nematus Erichsonii, Hartig.)

Dr. C. Gordon Hewitt, Dominion Entomologist, gave a brief description of his work on this insect in England, where it is becoming a serious forest pest. Its distribution in Canada is also increasing and the larches (*Larix americana*) as far west as Winnipeg, are now suffering from the attacks of this sawfly, which destroyed most of the larches in Eastern Canada subsequent to its appearance in 1882.

Only one brood was found to occur—the deposition of the eggs and the emergence of the larvae extended over a considerable period, and might give the impression that the species was double brooded.

The chief parasite was found to be *Mesoleius aulicus,* Grav., and investigation showed that in 1908 the average number of cocoons parasitised was 6 per cent., in the present year it was found to have doubled. Another ichneumon, *Microcryptus labralis,* Grav., was bred out and this insect is probably a hyper-parasite on (*M. aulicus.*)

One of the most potent factors in the natural control of the insect was the Field Vole (*Microtus agrestis,*) which extracted the larvæ from the cocoons during the winter, during which season the larvae form a large portion of their food. In one plantation about 50 per cent. of the cocoons were emptied in 1908 by these rodents.

Certain species of birds, such as the starling, rook, jackdaw and tits were of great importance in destroying the larvæ in large numbers. A scheme of attracting these species of insectivorous birds by means of nest-boxes was initiated and the results of the experiment were very gratifying, 33 per cent. of the boxes being utilized in the first year.

A species of *Cordiceps,* a fungous parasite, was found to be destroying a large number of the pupating larvae, and as the probable method of infection is terrestrial, this fungus may prove to be an important means of natural control.

The eradicative measures which were carried on against the larvae on the young trees were spraying with lead arsenate and crushing the larvae when they are in the "clustering" stage of their life-history, both of which measures were very effective in preserving the foliage of the trees under 8 feet high. Such measures of course cannot be employed in the case of large tracts of young self-sown larches, such as occur in many places in Canada; in such places natural means of control must be relied on.

NURSERY WORK IN ONTARIO.

By R. C. Treherne, Grimsby.

It is with a great deal of pleasure that I am enabled to give you a report on the Nursery work in Ontario. This year the Ontario Government, for the first time since 1902, instituted a general summer inspection of the nursery stock of Ontario, with a view to more effectually check the increase, distribution and ravages of the San José Scale and other pernicious insects which are prevalent in the nurseries, and also to gain a more precise idea of the nature of these attacks and the extent of their prevalence. A report, such as I am attempting to present to you at the present time, must necessarily be of a somewhat general character for the reason that the work is not yet finished and the final report is not yet completed. Nevertheless I will endeavour to outline to you the course adopted by the Government, which ultimately led to the formation of this summer inspection. The inspection is principally aimed at the San José Scale, but other insects, fungi and plant diseases are also included.

For the last three years sub-inspectors were appointed in the Niagara Peninsula where the bulk of the nursery stock is grown, and to quote from last year's report, "It was the duty of these men to watch closely to see that all nursery stock was properly fumigated before being shipped out, and also to report any instances of scale being found in the nurseries." Presumably the work of these inspectors was sufficient to show that the scale had become localized in many nurseries, and, in order to effectually combat the insect and prevent its spread it was expedient to discover its breeding places and distributing centres. With that view, then, the course of summer inspection of all nurseries was adopted: the Act which had already been passed prohibiting the sale of scale-infected stock was enforced, and inspectors were authorized to break down, or otherwise prevent from sale, affected stock in the nursery row.

The work was started in the Niagara District early in August of this year with two, and sometimes three, inspectors employed. They commenced at Stoney Creek and worked through to Queenston and at the present time (Nov. 4), are engaged in the Welland and Fonthill Districts.

The work has been delayed somewhat owing to the enormous amount of stock that is being grown and is ready for sale at the present time. According to last year's Fruit Branch Report, there were well over two million fruit trees growing in the nursery rows, to say nothing of grape and small fruit cuttings and the various ornamental shrubs that are being propagated. This year, I believe, the amount is still larger when all saleable stock is computed.

It is the duty of the inspectors to make a tree to tree inspection, locate the scale and dig up and destroy affected plants; and since a single man can only examine 15,000 to 20,000 trees a day, according to the nature of the stock and the care it has received, it can be imagined that the work is assuming great proportions. But it is work along the right line, and the nurserymen realize this.

Here it might be desirable to lay greater stress on the work of the local inspectors, whose duty it is to examine and enforce the law on those orchards found to be infested by scale throughout the country, but specially in the neighborhood of nurseries. For it is only by destroying the root of an evil that we can hope to accomplish results, and so long as infested orchards remain, just so long will the scale be found in the nursery.

From observation this summer it appears that the orchardist in very many cases neglects his duty to the Peninsula, and that the nurseryman in nearly every case is anxious to reduce the scale to a minus quantity.

Speaking generally, the San José Scale has been found in nearly all the nurseries thus far examined, and is found to be present in greater or less quantities, varying from one tree to several hundred, dependent on the locality. But little scale was found in the nurseries of the Stoney Creek District, but a considerable amount was found in the old Niagara District. A varying quantity was found between these two districts with a gradual tendency to increase from the former towards the latter. Scale is also very prevalent in the Fonthill District—greater infestation being to the north and north-west of the village.

Birds, and the procuring of scaly bud-sticks appear to be the principal means of the distribution within the nursery, while shipment after faulty fumigation seems to increase the area of infestation outside. It is peculiar that sometimes a three year old tree literally encrusted from the twigs to the ground, will be the only tree in a row affected, thus proving the necessity of a tree to tree inspection.

Remedial measures most commonly in use in the nursery are the Lime Sulphur Spray, Whale Oil Wash and the Carlson Mixture.

Besides the San José Scale, there is a long list of insects found on nursery stock. The most important, the most frequent and the most evenly distributed being Pear-Tree Slug, Leaf-Hopper, Red Spider, Oyster-shell Bark Louse, Blister Mite, Woolly Aphis, Bucculatrix, and the Trumpet Leaf-Miner.

From the botanical standpoint, the Cherry Mildew, Black Rot of Grape, Fire Blight, Bear Scab, Black Knot, Crown Gall and Hairy Root, are the most frequently observed fungous diseases.

It is hoped that future years will see this scheme of summer inspection continued. A fuller and more complete account of this year's work will probably be published in the Report of the Fruit Branch, Department of Agriculture.

During the discussion that followed, attention was drawn to Clause 2 of the Nursery Inspection Act, which states that:

"The Council of any city, town, township, or incorporated village may, and upon the petition of 15 or more ratepayers shall, by by-law, appoint at least one inspector to enforce the provisions of this Act in the municipality."

It was considered that there is a weakness in the clause which authorizes a Council to appoint an inspector, chiefly because the local man, from the very fact that he is a local man, does not inspire confidence. The fruit-growers and farmers with whom, in the performance of his duty, he comes in contact, ask one another the questions: "What does he know about the scale?" "Does he know the scale better than we do?" And further, the local inspector does not wish to risk disputes and wrangles and loss of his popularity by condemning a neighbor's orchard. On this account it would seem better to appoint as inspectors outside men, and that the Government should assume entire control of the work.

The following resolution was then unanimously adopted:

Moved by Dr. C. GORDON HEWITT, Dominion Entomologist, seconded by Mr. A. F. WINN (Province of Quebec), "that this Society, having heard from Mr. Treherne an account of the methods and work being done by the inspectors, wishes to express its great appreciation of the Ontario Government's arrangements for the inspection of nursery stock this season, and hopes that this important work will be continued with equal, or even greater, zeal in the future."

SOME GUESTS AT THE BANQUET OF BLOSSOMS.

BY F. J. A. MORRIS, TRINITY COLLEGE SCHOOL, PORT HOPE.

In 1905, my first season of collecting, I went over to England at the end of June on a botany trip. I had already begun to watch for beetles on blossoms before leaving Canada, though my chief hunting ground had been the bark of trees. In England I knew that the latter game-preserve was practically out of the question, as timber is far more scarce, and nearly all the woods are kept too clean for fallen timber to lie or wood to rot. If I meant to do any beetle-hunting, it must be by some other method, and I naturally made up my mind to combine hobbies by carrying a collecting-bottle out with me on my daily botanical rounds.

My first stay was on a small estate in Chislehurst, Kent. Here, in this garden within a garden, while wandering through a wood of hazel and oak, I came on a large clump of tall umbellifers in full bloom. I knew already from Fowler's and other books that such blossoms were a favourite haunt of certain beetles, and I made my way cautiously along a hedge of rhododendrons towards the clump. As I did so, there rose from between my feet a dark brown hawk-like bird, that flew up into my face and hovered for some moments in front of me; it was a nightjar, the famous goat-sucker of popular superstition, menacing, but powerless to fulfil a threat, being, indeed, cousin-german to our night-hawk and whip-poor-will, with all the furtive movements and ghostly silence of the creatures that fly abroad by night and hawk beneath the light of the moon. Like the nighthawk, it builds no nest, but there among the round flint pebbles by an oak lay its pair of eggs.

When first I got to the clump of flowering plants and scanned their broad white discs of blossom, among numerous diptera and hymenoptera, nothing was to be seen except a few butterflies, but presently I saw a large black and yellow Longicorn settle on an umbel some distance off. On approaching I found two of the beetles feeding and succeeded in catching one in my hand. They were very active, as quick as sunflies and almost as wary, so that capture was far from easy. I managed, however, to get a second specimen some time after. They proved to

be Strangalia armata; later on in the season I captured in North Wales a pair of Strangalia melanura, one on a composite, the other on a small umbellifer; and in Somerset, on the slopes of the Quantocks, I captured the more rare Strangalia quadrifasciata, sunning itself on a hazel leaf. The genus Strangalia is closely related to Leptura, and, like that genus, with its near allies frequents blossoms. So far I have not found any in Canada, though some species are, I believe, not uncommon. From the wood I passed into the kitchen garden, for I remembered a bed of orpine or livelong (Sedum telephium) where, 25 years ago, 1 could be sure of some Red Admirals (Pyrameis atalanta) and an occasional Peacock (Vanessa io), but alas! King Orpine's days were numbered, and Salpiglossis and Montbretia reigned in his stead. However, I spied a bed of asparagus and went over to review its ranks. I soon found that ladybirds were glutting themselves on a small dark grub about the foliage; it was probably the grub of the asparagus beetle (Crioceris asparagi), for I found a number of the mature insects on the leaves. Though very small, this beetle is extremely beautiful when alive, the vertical lines and cross-bars which appear black in cabinet specimens being of a rich dark green in the living insect. It has a curious habit when alarmed of thrusting its antennæ straight forward in front of the head and remaining motionless like a pointer; this habit is found in not a few of the Chrysomelians, as in some of the Longicorns, notably the Saperdas. I saw no trace of the 12-spotted species (*Crioceris* 12-*punctata;* indeed, at the time I did not know it occurred in Great Britain; but in September, 1907, I found both species on some asparagus in the late Dr. Brodie's garden in Toronto, and the last two years I have found the latter species abundant in Port Hope. In Dr. Bethune's day, I understand, it had not yet appeared there.

During the rest of my stay in England I did not do much collecting, as the month of August forms a sort of interregnum in insect activity between the early and the late broods. But I returned to Canada fully determined to prosecute my search among flowers and foliage in the coming season. I knew, of course, that I should thereby restrict my captures mostly to two or three families of beetles —the Scarabs, Longicorns and Chrysomelians, but to some such form of amateur specialism I was not at all averse.

Accordingly, from early April in the spring of 1906, I was out and about whenever I got the chance. It was not till May that my efforts met with much reward. A species of Œdemeris that frequents the dogtooth violet was almost the only capture. I had been told that a somewhat rare Longicorn was to be met with on the blossom of the trillium, but my informant could not tell me its name, nor did patient search in trilliums yield me any specimens of this family. About the 20th of May, however, blossomed the early elder, and though I wasted a great deal of time over elder clumps growing far away from woodlands, I did at last, by good luck, direct my steps to some growing on the edge of a wood about four miles north of the school. Here I found a new species of Scarab, leaden-gray in colour, though disguised for the nonce in a light yellow coat of pollen, with which it was thickly dusted over; it had long crooked hind legs that looked too clumsy to be of much use to their owner, and were, indeed, trailed along after it when it crawled. It was the male of *Hoplia trifasciata,* and I found it abundant for two or three weeks on the early elder, the choke-cherry, and the hawthorn; at first only the males were to be found, but about a week later the females became common; these at first I took for a distinct species, as they are very different in colour, yellowish-white, with three irregular bands of brown across

the back; on the hawthorn, however, where the female was in preponderance, I more than once found a pair. The same mistake appears to have made its way into print, and the two sexes were at one time assigned to distinct species, the male figuring as *Hoplia tristis,* and the female as *Hoplia trifasciata.* I found also on this clump of elder a few specimens of one of our earliest Lepturas, *L. ruficollis;* and, by way of a new illustration to the old adage that "it never rains but it pours," three specimens of what at first I took to be an ant, till on looking closer I saw the straight line down the back formed by the suture of the wing-covers and the gracefully curving antennæ that mark the Longicorn beetle. It was quite new to me, and my fellow-collector, though several seasons older than I, had nothing like it in his collection. There was nothing specially remarkable about its colour, which was blackish or dark gray, relieved by some transverse pencilled lines of white, and it was only 1-3 of an inch in length, but there was an elegance of form and outline that made it long a favourite in my little collection. This enthusiasm in a grown man doubtless seems absurd to the uninitiated, and I must admit, somewhat ruefully, that I found myself an object of pity rather than envy when I "talked beetles" to a brother of mine who has misspent the last 20 years of his life tiger-hunting in Madras and bagging lions in Rhodesia, in fact, generally making ducks and drakes of all his golden opportunities to collect rare Longicorns from tropical blossoms.

In the identification of this insect occurred an episode that I hope Dr. Bethune will pardon me for introducing here. At the close of this season of 1906 I purchased a copy of LeConte & Horn's key to the genera of N. A. Coleoptera. By a somewhat rough process of elimination I had decided my beetle belonged somewhere in the tribe *Clytini,* whose most familiar representative is probably the famous sugar-maple borer, *Plagionotus speciosus.* LeCorte & Horn's book made it probable that in the third group of this tribe, the *Anaglypti,* it would find its place. This group contains four genera, *Microclytus, Cyrtophorus, Tillomorpha,* and *Euderces.* Only one of these genera was at all known to me, and that from a single species (*Euderces picipes*) somewhat resembling the subject of my examination. I found first of all that the beetle I was trying to place had no ivory marks on the elytra, which put *Euderces* out of the question; the eyes were oblique and emarginate instead of round, which excluded *Tillomorpha;* it must be either *Microclytus or Cyrtophorus,* and the book gave one no choice, for in *Microclytus* the second joint of the antennæ was equal to the fourth, while in *Cyrtophorus* the second joint was much shorter, as it obviously was in my specimens. My fellow-collector had already sent a box of unidentified specimens to Guelph to be named, and when they came back I was naturally eager to learn the result. To my chagrin I found my little favourite christened *Microclytus gazellula.* This so mystified me that at last I wrote to Dr. Bethune, explaining the quandary I was in. To my great relief I got an immediate reply, that the beetle sent him had been identified from a cabinet specimen named by an older collector. LeConte & Horn were right, my beetle was *Cyrtophorus verrucosus,* as were those in the Guelph cabinet, though hitherto wrongly named.

I have examined a number of cabinets, and in none of them yet have I found more than an odd specimen of this beetle, nor have I met a Coleopterist who had captured it, except accidentally, as it were. But on the blossoms of the early elder, still more those of hawthorn, sometimes of choke-cherry, dogwood, spiked maple, viburnum and New Jersey tea, from the middle of May till early in July, I have found it abundant. It is then replaced by its near relation, *Euderces picipes,*

which frequents blossoms all July, especially those of New Jersey tea and milkweed, though often met with also on certain of the Rosaseæ and composites. It closely resembles *Cyrtophorus,* though considerably smaller and not so elegant in form; on the side of each elytron is a transverse white band, technically termed an ivory vitta; in the first specimens captured I did not recognize a new kind till I took them out of the killing-bottle.

This finding of a new species acts as a great incentive to the collector, not merely through the stimulus and encouragement of filling gaps in his cabinet, but through the interest and education of comparing closely-allied species and genera, and gradually following out the relationship of distinct tribes as the series of intermediate forms grows more and more continuous; thus retracing, as it were, the steps of natural evolution. It was, I know, a great encouragement to me to find the wide gap between, say, the Cyllenes and the Lepturas being gradually filled in and the various stages of the transition emerging, so to say, from the unknown. I believe it was the consequent redoubled efforts made by my fellow-collector and myself the next season, more than mere luck, that brought us an interesting discovery in the middle of June. On a certain Sunday morning I captured on spiked maple a specimen of an ant-like beetle, obviously belonging to the *Anaglypti* group, but neither *Cyrtophorus verrucosus* nor *Euderces picipes,* and in the afternoon of the same day on hawthorn, my friend captured a specimen of an ant-like beetle neither *Cyrtophorus verrucosus* nor *Euderces picipes.* Neither of us noticed his discovery till we came to turn out the contents of our killing-bottles on returning home. Stranger still, the new species we had captured, when we came to compare notes, proved different from one another. By a close examination of my friend's capture, I found he had at last got a genuine specimen of *Microclytus gazellula.* My capture has not yet been identified, but it may be referred almost certainly to the genus *Cyrtophorus.*

I have been led into something of a digression here, and for purposes of this paper I may remind you that we are in the month of May, and searching for beetle guests on the blossoms of the early elder. Through the middle of the wood where I made these first discoveries flows a small stream that has eaten out for itself quite a deep ravine through the limestone, clay and marl. About 100 yards up this glen grows a large shrub of early elder that opens about the end of May; on its blossoms we got several more of the *Leptura ruficollis,* but nothing new that season. In 1907, however, while my fellow-collector was examining the blossoms, he spied a new Longicorn, of which he captured three specimens, and a day or two later, from the same shrub, I managed to get two. Though there were several other elder bushes in the wood, we have found this beetle on none of them, only on this one tree, and it has yielded us from 3 to 5 specimens every season since. As far as our experience goes the beetle is active from the end of May till nearly the end of June. In 1907, from another locality I took two specimens on dogwood blossom; in 1908 I got three or four specimens on dogwood and on the thimble-berry, and in the season just over we both saw specimens feeding on hawthorn blossoms. It is the *Pachyta monticola,* a very pretty insect with pale yellow elytra, boldly marked with black or deep crimson. This genus is closely related to the Lepturas, but broader across the base of the elytra, and thicker through the sternum; its thorax, too, instead of being rounded at the sides, is armed with an excrescence known to Coleopterists as a "process." In 1907 and 1908 I succeeded in capturing a few specimens of two more species of *Pachyta,* smaller than *monticola,* and inconspicuous in colour, black, or black with dark

brown streaks on the wing-covers. They were taken late in June, feeding on the blossom of dogwood. And with every fresh discovery I swelled with pride as I found myself getting more and more intimate with this royal family among beetles, the Longicorns.

With the passing of May the early elder came to an end, but before it was over the hawthorns began to bloom all over the neighbourhood. Our first field of investigation *was* a field, an extensive pasture bordered on one side by a wood of pine, beech and maple. At first I went all about the farther end of the field wherever the snowy mass of hawthorn bush in full bloom drew me, but I soon found that it was only near the wood that my search was rewarded; the first captures were a couple of Scarabs called *Trichius piger,* a beetle looking very much like a small bumblebee and extremely active; it is abundant on blossoms from early in June till the middle of July, and may be found on a great variety of flowers. Then I got my first specimen of *Dichelonycha elongata,* another Scarab, which is particularly fond of basswood foliage, and becomes some seasons a veritable plague. Finally I came to hawthorns on the border of the wood, and here I found several Longicorns feeding. Among them three Lepturas that were new to me, *Leptura pubera, L. mutabilis* and *L. vibex,* of the last two only a single specimen. About the same date I paid a visit to the wood four miles away, to see what guests the hawthorns there were entertaining. On one bush at the edge of the wood I found both sexes of *Hoplia trifasciata* plentiful, two or three specimens of *Dichelonycha,* and a lot of *Leptura ruficollis* and *Cyrtophorus verrucosus;* and besides these a new insect that at first I passed over for a fly, till the long antennæ betrayed it; these in the female were about the length of the body, in the male twice as long; it was the more easily mistaken for a fly in that its wing-covers were reduced to a mere pair of epaulets or shoulder pads. It proved to be the Longicorn *Molorchus bimaculatus,* and was very abundant throughout June on several sorts of blossom. On another bush at the edge of the wood I found a regular colony of Chrysomelians busy in the blossoms. I sent three of these to Guelph, where they were identified as varieties of *Orsodacna atra;* in June, 1907, I found the same beetle on hawthorn blossom at Lakefield, and I have taken it also on viburnum; in no case did I find the normal form of *O. atra,* though a few of my specimens approximated very closely to it.

A curious feature about the hawthorn and its guests is that some shrubs apparently as favourably situated as others and in full bloom, were deserted and others crowded. It may prove that some species attract beetles and others do not; Gray's New Manual enumerates 65 species of hawthorn in N. A., while in Sargent's Monograph on the Cratægus in some parts of Ontario alone (as published in last year's Wellington F. N. Bulletin), no less than 95 species are distinguished. The results of closer determination in the species of plant hosts might prove interesting.

An encouraging thing about this sort of collecting is that seasons vary in the maturing of both hosts and guests, so that often you will find species frequenting blossoms that the year before they did not visit, and sometimes you will come across an entirely new insect. Two seasons ago, for instance, early in June, we found a strange beetle abundant on dogwood; it proved to be *Callimoxys,* a first cousin of *Molorchus;* in this genus the wing-covers are not short as in *Molorchus,* but awl shaped, so that the inner margins do not lie together in a straight line. Again this last season I made a new find on hawthorn in the shape of a small oak-pruner (*Elaphidion*). Much, too, may result from search in a new neighbourhood;

in 1906 I found scores of *Lebia furcacta* (a small Carab of the Bombardier group) feeding on golden-rod about the margin of a swamp at Lanark, and last July I captured two fine specimens of the large blister beetle, *Pomphopœa Saya,* in Muskoka, upon nannyberry (*Viburnum lentago*).

When the hawthorn began to bloom in 1907, I went eagerly back to work my claims, for the bloom of a hawthorn last barely a week, and seems to attract insects for only a day or two. I had already ruled out the shrubs growing in the open; so I went first to the edge of the wood, but this faced west, and was exposed to a chilly wind. There was nothing to be found, and I followed the gleam of hawthorn north across some stump lands to a large wood; skirting its west and north border, I came presently to a stretch of low swampy ground that penetrated the wood in a southerly direction, and was entirely out of the wind. It was thickly grown with dogwood and spiked maple, both of which were in the prime of their bloom, and in full sunshine. The number of insects feeding on the blossoms was astonishing: in an hour or two I must have captured several hundred beetles. Besides *L. ruficollis* (with its variety *sphæricollis*), *L. vibex* was plentiful and so was *L. mutabilis,* whose name now for the first time became clear to me, both forms being abundant, the light brown and the dark gray; I found also a very small *Leptura* that was new to me (*L. subargentata*), and the beetle, *Encyclops cœrulea;* there were also a few specimens of *C. verrucosus,* and it was then that I got my unidentified species of *Cyrtophorus.* There were, of course, other families of beetles; in particular, Elaters, of which I captured four new species, one of which I have never seen except on spiked maple, the head and thorax dark brown, ending in a reddish-brown base, the elytra yellow-green, tipped with dark brown. On the same blossom in another locality I have taken three more Elaters, *Corymbites hieroglyphicus, C. propola,* and a third species not yet identified, prettily marked with dark wavy lines across the wing-covers; besides these, yet another Leptura (*L.* 6-*maculata*). *L. vibex* seems fairly to revel in these moist woody hollows, and later on in the same place on black elder I found *L. lineola* abundant. It is evidently addicted to black elder, and partial to moist woodlands.

As June drew to its close we extended our search to the south slope of a long ridge of high land, some 6 miles north of P. H. On this slope grew the New Jersey tea, and as there were many groves of standing timber, as well as berry patches and thickets of small trees and shrubs, we felt confident that we should make some finds. Our first visit to this place (which we dubbed "the Rocky Mountains") found the New Jersey tea still some days short of blossoming, but there was dogwood in bloom on the slopes, and almost the first bush we visited brought us three or four new beetles, among them *Gaurotes cyanipennis,* of the Lepturoid group, a stout, robust beetle, resembling in form *Pachyta monticola,* very handsome and of a brilliant dark green hue, and *L. capitata,* a beetle we at first took for *ruficollis,* but more tapering in outline, and with head crimson as well as thorax.

With the first days of July, along the southern slope of our local Rocky Mountains the New Jersey tea and late elder expanded to the sun, and the whole hillside became a revel of insect life. The delicate fragrance of the New Jersey tea would no doubt at any time attract guests to its dainty white clusters, but coming, as its blossoms do, jump with the height of insect activity, and in the most glorious weather of the year, the sun blazing through a breathless atmosphere, the number and variety of guests swarming to the feast were almost beyond belief. Some-

times an altercation would arise, when some blundering glutton (like *Bombus* or *Trichius*) tried to elbow his way into a blossom where there was no longer standing room. But "with them," as Wordsworth points out, "no strife can last."

> "For why?—because the good old rule
> Sufficeth them—the ancient plan
> That they should get who have the power
> And they should keep who can,"

—and the weakest go to the wall.

Among the many new species we met with in these happy hunting-grounds were several members of the group *Clyti,* between the *Cyllenes* and the *Anaglypti;* of this group we found an occasional specimen of *Xylotrechus colonus,* and a small *Neoclytus,* while *Clytanthus ruricola* was abundant. In the Lepturoid group we took many specimens of a genus we had not found at all before, *Typocerus,* of which we met with three distinct species, one black (*T. lugubris*), one black and yellow, banded like a wasp (*T. sparsus*), and a third mottled with patches of straw-colour and reddish brown (*T. velutinus*).

In midsummer heat, insects seem to grow nervously alert and restless and we found the Typocerus often defied capture; they would hover at a blossom without settling, like miniature humming birds, their tiny wings fanning with marvellous velocity, while their flight from one point to another was of the swiftest. A small beetle in flight is never conspicuous, and some of them when they settle on a blossom seem to have stepped out of the infinite, and when they take to flight again they pass away into a 4th dimension, as though, like Wordsworth's skylark, they too enjoyed a "privacy of glorious light," but one that needed no soaring to gain. More than once we found with birds of this feather that one in the hand was by no means worth two in the bush; there proved many a slip between the cup of one's closed fist and the lip of the cyanide bottle.

To the Lepturas themselves, already a long list, we added *L. subhamata, zebra, vagans, proxima, biforis, vittata, Canadensis,* and three species at least unidentified. Of these, *proxima* and *subhamata* seem to prefer the elder, and *Canadensis* the milkweed. In the same neighbourhood, from the heart of a dogrose I flushed an *Oberea bimaculata,* and from plants of the wild bergamot, with its sweet fragrance and delicate lavender blossoms, a whole covey of some smaller *Oberea* that I have not yet identified. I say "flushed" advisedly, for in the first instance I did not bag my bird; indeed, I chased it for two years before I caught it (the species, that is, not the individual). It is a small insect, of very narrow outline and black in colour; when flying it is almost invisible, only the practised eye can make out a minute and swiftly-moving shadow. You will get some idea of the hunter's difficulties when I say that I found it fatal to wink the eye while marking its flight; the creature simply disappeared like the skylark at the last point of vision. For one thing, it has a dodging flight, like that of a snipe, and to make its assurance of escape doubly sure it never settles on the upper side of a leaf, but always underneath. Even then it is seldom off its guard; if you cast so much as a shadow, it is off like a trout in a pool. I tell you there was rejoicing in the camp, if not feasting, when I came home with the scalp of *Oberea bimaculata* at my belt.

But in so fair a scene as the Port Hope "Rocky Mountains," disappointments cast but a passing shadow. The place was a perfect Paradise of flowers, and as we wandered in sunshine beneath the vaulted blue, over beds of New Jersey tea, through thickets of raspberry and thimbleberry, among brackens and orange lilies,

by fences festooned with grapevine and smothered in dogrose, everywhere a riot of blossom and insect life. Nature transfigured with the glory of the July sun, we thought of the wonderful interdependence of all living things on earth, and felt—I hope I may say it without irreverance—that it was good to be there.

"Such life there, through such lengths of hours,
Such miracles performed in play,
Such primal naked forms of flowers,
Such letting Nature have her way,
While Heaven looks from its towers!"

EVENING SESSION.—THURSDAY, NOVEMBER 4.

At 8 o'clock p.m., a public meeting was held in the Massey Hall auditorium, which was well filled with students, both male and female, and a number of visitors from the town as well as members of the Society. The chair was taken by Dr. Bethune, Professor of Entomology. The proceedings were much enlivened by musical selections excellently rendered by the College Orchestra under the direction of Mr. J. D. Tothill, fourth year student in Biology, and a piano solo by Mr. Roy Fraser, another student in the same department.

After a few remarks by the Chairman on the origin and progress of the Society which was celebrating its forty-sixth anniversary and the near approach of its jubilee, he introduced the speaker of the evening, Dr. C. Gordon Hewitt, the newly appointed Dominion Entomologist, who was taking up the work at the Experimental Farms so long and so ably conducted by their lamented friend, the late Dr. James Fletcher. It was a great pleasure to welcome Dr. Hewitt to Canada, and to have his kindly assistance during the proceedings of the annual meeting of the Entomological Society.

HOUSE-FLIES AND THEIR ALLIES.

Being the major portion of a lecture delivered before the Entomological Society of Ontario, on November 4th, 1909, by C. Gordon Hewitt, D.Sc., F.E.S., Dominion Entomologist, Ottawa.

It is an especial pleasure to me to have this opportunity which the Entomologists of Canada, in inviting me to give this address, have afforded me, of addressing my first remarks in public in Canada to the Entomological Society and the students of the Ontario Agricultural College and the Macdonald Institute. It is, in a sense, my official introduction to you, and the cordial reception which I have been accorded on all sides, and especially during the meeting, have been most encouraging, and I can only say in reply to it all that while I have the honour to be Dominion Entomologist it will be ever my object to further the science of entomology, especially Canadian entomology, and by the application of the results of scientific research to deal with those varied problems, both great and small, which confront the entomologist when dealing with injurious insects and their control.

The subject of my address this evening is one that is familiar to you all. In Canada I find you know the house-fly only too well. It is man's most constant com-

panion and the most truly "domestic" animal in the world. Wherever man has gone the house-fly has followed in his steps, from the arctic circle to the burning tropics it dances in constant attendance, the uninvited guest. And yet, in spite of all this, notwithstanding the fact that no living creature paid him so much attention, he did not trouble himself about it beyond a most cursory inquiry into its habits and life. This is not infrequently the case in zoological science; we write monographs of inordinate length on species of animals whose chief recommendation is that they are rare, whereas on the other hand, those animals, frequently of great interest and importance, that are waiting on the threshold of our laboratories for inquiry are passed over. The house-fly is one of the greatest examples of this. In 1790, Keller made an excellent study of the "Stubenfliege;" he studied the life-history and anatomy and anyone who has seen the beautiful memoir which he wrote and the charming illustrations will be filled with admiration and wonder that so much could have been done with the scientific apparatus then at the investigator's disposal. Previously and subsequently to that, those great naturalists, Reaumur, DeGeer and Bouche, all included a short description of this insect and its habits in their classic works. Since that time the only investigators who contributed really valuable information have been Packard and Howard, who have studied the life-history and habits in the United States. There is no need for me to call the attention of Canadian entomologists to the great importance of Dr. Howard's work, the value of which lies in the fact that he, above all investigators, showed the people of the United States, and of other countries too, the serious rôle which the house-fly plays in our national life. I need only refer to the excellent work which is being done by the New York Merchants' Association to combat this danger from flies—than which such an association could do no work more worthy—as an illustration of the manner in which a corporation has taken the warnings, has proved them beyond dispute for itself and is applying the results of such knowledge as it has gained to the amelioration of public life.

It has been my good fortune during the past few years to be able to add a little to our knowledge of this insect by a detailed study of its anatomy of which we had no previous account, and its life-history and habits. The result of that work has now been finished, though like most investigations it is not complete and it is my intention to-night to give you briefly and in a popular manner some of the results of my work and of the work of others who have been studying the habits of this insect.

First of all, you must understand that several species of flies inhabit houses, some of these are frequently mistaken for the true house-fly (*Musca domestica*). This species is easily recognizable by having on the dorsal side of the thorax four almost black longitudinal stripes on a dusty grey ground which in certain lights has a golden shimmer; the ground colour of the abdomen is a buff yellow and there is a dark brown median dorsal stripe; the whole of the dorsal side of the abdomen, however, is overspread with a reflecting grey which gives it a blotchy appearance. The average size of this species is 6-7 mm., but unfavourable conditions in the larval life tend to produce dwarf specimens of the adults. The occurrence of these smaller specimens was no doubt partially responsible for the popular idea that they were *young* house-flies and this in turn led to the mistake that many non-etomological people make in believing the other species of fly which occurs in houses, namely, *Homalomyia canicularis,* to be a young *M. domestica.* This lesser house-fly differs on examination very considerably from *M. domestica.* In the venation of the wings the fourth longitudinal vein of the wing of *H. canicularis* goes straight to the margin as in all the members of the group *Anthomyidæ,* whereas in *M. domestica*

it is bent up at an angle before reaching the margin which it joins close to the termination of the third longitudinal vein; not only is it smaller, but in form and colouration *H. canicularis* differs from *M. domestica.* The dorsal surface of the thorax of the male is greyish black with three indistinct longitudinal stripes, the male's abdomen is slender and tapering compared with that of *M. domestica;* it is bronze black with three or four pairs of translucent yellow lateral areas. The body of the female is coloured a dark ash-grey and the thoracic stripes are more distinct, the abdomen shorter and more robust.

Musca domestica forms by far the major portion of the fly population. Howard's, Hamer's and my own observations show that the percentage is usually 90-98 per cent. of the total fly population.

Another fly that sometimes occurs in houses, especially country houses in the fall, and also in the spring in England, and whose habits have frequently led to the popular erroneous idea as to the ability of the house-flies to bite, is the blood-sucking *Stomoxys calcitrans*, known by various popular names such as Storm-fly, Stable-fly, Fall-fly, all of which names are equally inapplicable to one species. It can readily be distinguished from *M. domestica* by the sharp awl-like piercing proboscis which projects forward horizontally from beneath the head. This type of proboscis enables it to pierce the skin of animals and thereby suck the blood of the same. It is interesting to note in passing that *S. calcitrans* is allied to those tropical blood-sucking Diptera of the different species of Glossinas, which are responsible for the deadly disease of sleeping sickness and Nagana. They carry the Trypanosomes, the organisms which cause the diseases, and by their blood-sucking habits infect man and other animals. The former disease has reduced in a few years the population of Uganda by two-thirds and Nagana has rendered central and sub-tropical Africa practically impassable to horses.

Musca domestica possesses a proboscis that is quite incapable of piercing the skin. It is only of use in absorbing fluids and this process of absorption is one of great interest. The proboscis is extended in the following manner. The vacant spaces in the head are filled with capacious air-sacs and blood; by the inflation of these air-sacs of the head the blood is driven into the cavity of the proboscis which is thereby extended and the two lobes which form the oral disc are distended by means of the blood. These oral lobes are traversed on their inner sides by a very large number of channels which are kept open by minute rings open at one side—and owing to their tracheal appearance are called pseudotracheæ. The oral surface is applied to the fluid-moistened surface and by capillary action and the pulsating movement of the oral lobes the fluid runs along the pseudotracheæ into the oval pit and thence into the pumping pharynx—the pumping action of the latter keeping up the constant inward flow of the solution. In the case of such solid food as sugar this is first rendered soluble by the secretion of the lingual or salivary glands. The surface of the oral lobes is kept in a moist condition by the secretion of a small pair of labial glands.

If the abdomen of a mature female fly is opened it will be found that it is almost filled by the enormously distended ovaries; the alimentary tract occupying a small trough-like cavity between them and the dorsal region. In the posterior region of the abdomen the ovipositor will be seen usually in a retracted telescopic condition. When exserted the ovipositor is about equal in length to the abdomen and the female fly is thus enabled to deposit her eggs deep down out of the light in the crevices of whatever substance, decaying vegetable or excremental, it may have chosen as a nidus for the larvæ. About 120 to 150 eggs become mature at the same time and these are deposited in clumps, as many as sixty or seventy may

be found packed together in one clump. The eggs are pearly white in colour, marked with very fine sculpturing; they are 1 mm. in size, slender and cylindrically oval, one end being more pointed than the other and along the dorsal side of the egg there are two curved rib-like thickenings of the chorion. The eggs of *M. domestica* have not the appearance of the grooved wheat grain as stated by several writers. It has been found that horse manure is the special breeding place of flies, but they will deposit their eggs and the larvæ are able to feed on almost any kind of excremental products and in decaying vegetable substances such as kitchen refuse, especially if such substances are in a fermenting condition. They will also deposit their eggs in decaying fruit and certain food stuffs such as moistened bread, egg, broth, etc. The most important factor which governs the development of the larvæ is temperature; a high temperature accelerates the development. It is also affected by moisture, diminution in the amount of moisture retards development and by the character of the larval food and fermentation. The shortest time which I was able to obtain for the development of *M. domestica* was eight days. This was obtained by keeping the larvæ at a constant temperature of 35 degrees C., and the times occupied in the different stages were as follows:—egg from deposition to hatching, 8 hours; whole larval or "maggot" stage 5 days; the larvæ moult twice and the times occupied in the three larval stages were 24 hours, 24 hours and three days respectively; the pupal stage lasted three days. These times are probably as short as will be found usually under natural conditions. Under unfavourable conditions, with regard to temperature, moisture, etc., the development has been found to extend over several weeks. In no case, however, was it found possible to keep the insects in the pupal stage during the winter nor do I know of any other observer who was able to do so. They invariably pass the winter as adult flies, and under suitable conditions of temperature and the presence of larval food, are able to breed during the winter months. The newly hatched larva measures 2 mm. in length and the average length of the adult larva is 12 mm. It is a typical, conically cylindrical, muscid larva, or "maggot," consisting of thirteen segments. It progresses by means of seven pairs of locomotary pads on the ventral side of the body and these are covered with small spines. The intestine of the full-grown larva is very complicated as will be seen from the figure thrown on the screen. When the larva is full-grown it retracts the anterior and posterior ends to form a barrel-shaped
pupal stage lasted three days. These times are probably as short as will be found
from a creamy yellow to a dark chestnut brown. When the fully developed fly emerges from the pupal case it pushes off the front end of the case in two sections by means of an inflated sac in front of the head; this sac is afterwards withdrawn into the head. After emerging from the pupal case the fly crawls about until its wings have attained their permanent form and the body has hardened and dried. In my experiments I found that the flies became sexually mature in ten to fourteen days after their emergence from the pupal state, and four days after coitus with the male they began to lay their eggs which was possible therefore from fourteen days after emergence from the pupæ. It will be seen from actual observations and experiments that in hot weather the progeny of a fly may be laying eggs in about 3 weeks from the time the eggs from which they were hatched were deposited, and as a fly may deposit about six hatches of eggs in a single season, it is not difficult to realize the millions of flies which a few flies may produce in the hot summer months. These observations indicate two important points: first, the necessity of destroying the *first* flies that appear in the season, and secondly, the abolition of their breeding places. In our towns and cities owners of stables should be compelled to either remove collections of manure

within seven days or to treat the manure with such a substance as chloride of lime or mineral oil as each lot is thrown on the heap to prevent the breeding of the flies and such manure should be kept in a chamber to which flies cannot obtain access. The first method is the best and most effectual and certain cities have now by-laws enforcing such periodic removal of manure. All cities and towns should enforce such removal or treatment, nor should they allow the accumulation of rubbish and substances on which flies can breed as many local authorities are accustomed to do. It is invariably found in such cases that the maximum number of cases of zymotic diseases such as typhoid and epidemic diarrhœa are located around such places. The change of attitude of people towards house-flies during the last few years has been remarkable. Public opinion on such subjects is slow in changing and although we had known for years from the work of Celli, Nuttall, Hoffman and many others that flies were in the habit of carrying the bacilli which cause certain of our infectious diseases such as typhoid fever, ophthalmia, tuberculosis, etc., it was not until medical men as a whole began to realize the important rôle that house-flies play in the dissemination of these diseases that we really began to move. But now there are fortunately few who do not realize the danger of the house-fly. What could be more probable than the transference of disease-carrying bacilli by flies when they have access to the dejecta of incipient or carrier cases of typhoid on the one hand and food materials on the other. Several observers during recent campaigns and also in military camps in time of peace have observed flies frequenting the food in the mess tents and carrying on their bristle-covered legs the white disinfectant from the camp latrines. Such an observation is sufficient to convince the most obstinate sceptic as the relation that flies may have in the transference of disease germs. Take, for instance, the flies in unsanitary localities; they are accustomed to frequent every kind of filth in the way of kitchen refuse and excremental substances and to spend a portion of their time regaling their palates with the food stuffs in the houses, especially such articles of food as sugar and milk. It has been proved that milk to which flies have had access becomes seriously contaminated with and infected by the bacilli which the flies have obtained from filth of different kinds and milk is an excellent medium for the growth of bacilli, especially during warm and hot weather.

What are the methods, then, which we have of combating this most serious menace, for, to my mind, the fly problem in our cities is far more important than the mosquito problem towards the solution of which thousands of dollars are spent annually—and compared with which the suppression of the fly danger is indeed as simple. They are these. First, the abolition of their breeding places; the removal within seven days in the summer, of collections of horse manure, decaying and fermenting vegetable substances on which the flies can breed. The substitution of the more sanitary system of sewage disposal by water instead of the older and generally insanitary and dangerous methods of conservancy. The protection of collections of manure or kitchen refuse: keep the lid on the refuse chamber. Do not allow flies to have access to food, especially such foods as milk, sugar, etc., but, where flies occur, keep all such food covered with a muslin covering. Farmers and dairymen should not leave milk about exposed and accessible to flies. A man would not be willing that flies should have access to a glass of milk intended for his own consumption, and why should he leave milk exposed in pails in cow-sheds and similar places where the flies have a maximum opportunity of covering their legs and bodies with bacilli of all kinds, especially putrefactive bacilli. "Prevention is better than cure" is almost a truism, but the welfare of the future will depend almost entirely on that one word, Prevention. Nature is yielding up her

secrets one by one through the toil of men of science, and it is by the application of the knowledge thus gained that we shall be able to avoid that great rod of chastisement of Nature, disease, which is inflicted on those who disobey or transgress her unwritten laws.

And while we have these insects arrayed against us there are others allied to them which, by assisting in the maintenance of a balance in nature take up their position on our side. These are the Tachinid flies, many of which, to the casual observer, have a superficial resemblance to the house-fly. There are a very large number of species of Tachinidæ and considerable variation in size and structural characters. The larvæ of most of them are parasitic on lepidopterous larvæ, and in certain cases these parasites increase to so great an extent that they may suppress completely an exceptional increase of caterpillars. It is largely owing to these parasites and the Ichneumons that our vegetation is not completely eaten up by lepidopterous larvæ. The Tachinid maggot feeds inside the caterpillar and gradually destroys the tissues of the host. In some cases the maggot leaves the caterpillar before it pupates, in other cases the caterpillar pupates and the Tachinid maggot pupates inside the cocoon or pupal cell. Their life-histories are extremely diverse and this is frequently found to be the case in the life-histories of the members of a group of animals which has assumed parasitic habits, whether it be insects, crustacea or more lowly organisms. Parasitism induces profound changes in the life-history of animals, and we find great variations in so small, comparatively, a group as the Tachinidæ. Whereas some of the insects deposit their eggs upon the skin of the caterpillars, from which position on hatching the larvæ bore into the interior of the host; others deposit their eggs upon the leaves of the plant as, I believe, is the case in *Ugimyia sericaria*, Rond. which is the cause of the most serious "Ugi" disease of the Japanese silkworms. The caterpillars, on feeding on the leaves, take the eggs in biting off the portions of leaf to which they are attached, into their digestive tracts where the maggots emerge and bore through into the tissues of the body. A third class is exemplified by the species *Eupeleteria magnicornis*, Zett, which, as Townsend has shown, deposits living maggots not on the caterpillars, but upon the green shoots, leafribs, etc., on which caterpillars were present and usually on the silken thread spun by the caterpillar on its trail over the plant. It will be recognized that the first method is the one in which the maggot is least sure of success in entering the host, for it not infrequently happens that the caterpillar moults before the eggs of the Tachinid hatch and thus rids itself of the danger. So that although we may find Tachinids depositing their eggs freely upon caterpillars, it is unsafe to predict beneficial results. Howard, for example, mentions a case in which 226 moths and only four Tachinid flies were obtained from 235 caterpillars of the Gipsy Moth, upon each of which 1 to 33 Tachinid eggs had been observed. In another case, 252 caterpillars, all bearing Tachinid eggs, were reared and not a single fly emerged. These cases illustrate well the advantage to an insect larvæ of such a method of growth by the moulting of the old skin. Once inside the caterpillar the maggot bores its way into the body cavity or blood cavity and immediately attaches the breathing pores at the posterior end of its body to one of the breathing pores of spiracles of its host and thus obtains its air direct from the outside. In this position it remains during the whole of its larval life, until it is full grown. It moults twice and the old skins remain attached at the posterior end of the body as the maggot does not leave the spiracle of the caterpillar to which it has once attached itself, until it finally leaves it to pupate.

Allied to these insects are the Anthomyidæ, some of whose larvæ are the destructive root-maggots, which feed on the roots of many vegetables, such as cabbages,

radishes, onions, beans, etc. A few years ago I found, when studying the life-history of *Musca domestica,* that the flies of the root-maggot (*Anthomyia radicum,* Meigen), were especially fond of laying their eggs on horse manure in which the larvæ were reared. This fact may account frequently for the presence of root maggots on crops, as it has been found that fields heavily manured suffer more from the attacks of root maggots than those on which there is less manure or which have been manured some length of time. Such facts as these have to be borne in mind in cultivating infested areas.

These few cases of the economy of certain allied insects will illustrate to you the benefits and injuries that are the result of different modes of life of insects somewhat closely allied and show how the knowledge gained from a careful study of the life-histories and habits of life or bionomics can be applied to further the welfare of man.

At the close of Dr. Hewitt's lecture, which was illustrated by a number of beautiful lantern slides of the life stages of various species of flies and of their structural and anatomical details (Plate F, page 141), a hearty vote of thanks was given him. President Creelman, in proposing the vote, and Professor McCready, in seconding it, spoke in high terms of the excellence of the address and the gratification that all felt in the appointment of so well qualified a successor to the late Dr. Fletcher.

The chairman referred to the measures that had been put in operation for reducing the number of disease-bearing flies in the city of New York, and the encouraging diminution in the percentage of cases of sickness and death during the later months of summer, especially amongst children. The meeting was brought to a close with a musical performance by the orchestra and the singing of "God Save the King."

SECOND DAY'S SESSION—FRIDAY, NOVEMBER 5TH, 1909.

The President, Mr. TENNYSON D. JARVIS, took the chair at 9.30 a.m., in the Biological lecture-room of the Ontario Agricultural College. There was a good attendance both morning and afternoon, including many of the students as well as members of the Society. The first order of the day was the reading of the reports of the Council, the Branches at Montreal and Toronto, and of the different officers of the Society. The Montreal Branch was represented by Mr. A. F. Winn, and Toronto by Mr. J. B. Williams. The report of the Delegate to the Royal Society was read by Mr. A. Gibson, of Ottawa. This was followed by the election of officers for the ensuing year, 1909-1910 (see page 6).

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario begs to present the report for the year 1908-09.

The forty-fifth annual meeting of the Society was held at the Ontario Agricultural College, Guelph, on the 5th and 6th of November, 1908. There was a very satisfactory attendance of members from a distance as well as those locally resident; a considerable number of the students of the College were also present.

The first afternoon was occupied with the reading of the reports of the Directors on the insects of note in their respective districts, and a conference was held on the chief insect pests of the season, which was participated in by many of those present. In the evening a public meeting was held in Massey Hall, and a popular lecture was delivered by Dr. E. P. Felt, of Albany, State Entomologist of New York, on "The Interpretation of Nature," illustrated by lantern pictures. A paper was also read by Prof. Lochhead, of the Macdonald College, St. Anne de Bellevue, P.Q., on "Entomology in the Graduate School of Agriculture at Cornell University."

The morning and afternoon of the second day were occupied with the reading of the reports of the various branches and officers of the Society. Papers were also read on a variety of subjects, both scientific and practical. All of these have been published in the annual volume. This volume, the "Thirty-ninth Annual Report to the Legislature of Ontario," was published in March last, and contained 152 pages and 18 half-tone plates of gall insects, also a portrait of the late Dr. James Fletcher. The papers were further illustrated by over 40 figures in the text. Besides those already mentioned, it included the following articles: "What Entomology the Farmer and Fruitgrower should know," "The Strawberry Weevil," and "Injurious Insects of Quebec in 1908," by Prof. Lochhead; "A Catalogue of the Gall Insects of Ontario," "Apparatus for Collecting small Arthropods," and "Notes on the Coccidæ of Ontario," by Mr. T. D. Jarvis, President of the Society. Among the popular papers were, "Beetle Haunts," by F. J. A. Morris; "A Farmer's Wood Lot," by Dr. Fyles; "The Importation of Parasites of the Gypsy and Brown-tail Moths," by Dr. L. O. Howard, Chief of the Bureau of Entomology, Washington. The remaining papers were of a more or less scientific character, viz: "Hydrœcia Micacea in Canada," and "The Entomological Record," by Mr. Arthur Gibson; "The Life History of Euchætias Oregonensis," by Mr. H. H. Lyman; "Observations on the Sorghum Midge," by Mr. R. C. Treherne; "Enemies of Ontario Coccidæ," by Mr. A. Eastham; "Two Butterflies added to the Montreal List," by Mr. A. F. Winn; "Collecting with a Lantern Trap," and "Notes on Lachnosternas," by Mr. J. D. Evans; "The Tussock Moth in Toronto," by Mr. P. Hahn; "The Economic Importance and Food Habits of American Gall Midges," by Dr. E. P. Felt; "Injurious Insects of the Year," by Dr. Bethune and Mr. Gibson.

A few days after the close of the meeting the members of the Society and a host of friends all over the continent were shocked and deeply grieved at the sad tidings that our much loved President, Dr. James Fletcher, was no more. His death took place at Montreal, on Sunday, November 8th, 1908, after an operation from which he had not the strength to rally. A great man, a master mind, an enthusiastic student of nature, a most lovable personality has been taken from us. In our last report a full obituary notice was given. It is therefore unnecessary to enter into any further account of the work of our lamented friend.

"The Canadian Entomologist," the monthly magazine of the Society, has been regularly issued at the beginning of each month. The fortieth volume was completed in December last, and eleven numbers of the forty-first volume have already been published. The volume for 1908 consisted of 471 pages, and was illustrated by 11 full-page plates and 20 figures from original drawings. The contributors numbered 69 and included writers from Ontario, Quebec, Manitoba, Alberta, British Columbia, England, the United States, Brazil, Norway, and the Hawaiian Islands. The articles are, as usual, largely of a scientific character, and

contain much highly valuable matter. No less than 33 new genera were described, 282 new species and 9 varieties or subspecies of insects belonging to various orders.

The reports from the branches of the Society, at Montreal, Quebec, and Toronto, are highly satisfactory, meetings having been regularly held and many papers read and discussed. Owing to the absence of the Secretary in England no report was received from the British Columbia Branch.

Meetings of the Society were held from October to March at the Ontario Agricultural College, Guelph, on alternate Wednesday evenings. The attendance included a number of the more advanced students and a gratifying amount of interest was shown by all who attended. The following papers were read during the season: "The Sorghum Midge in Louisiana," by R. C. Treherne (4th year student); "A Classification of Muscoidean Flies," by W. R. Thompson (4th year student); "Rearing Pomace Flies," by E. W. Stafford (4th year student); "Suggestions for Field Inspection," by R. C. Treherne (4th year student); "Notes on Eriophydæ," by J. Tothill (3rd year student); "Memoir of the late Dr. Fletcher," by Dr. C. J. S. Bethune (Professor of Entomology); "Some Notes on Mites," by T. D. Jarvis (Lecturer in Entomology); "The Chalcidid Subfamily Encyrtineæ," by Alfred Eastham (4th year student); "Remarks on the External Anatomy of Chalcids," by A. C. Baker (2nd year student); "The Genus Tetranychus," by R. C. Treherne; "The Entomological Department at Macdonald College," by A. G. Cutler (4th year student); "Spiders," by Dr. C. J. S. Bethune; "Injurious Insects of the Season," by L. Caesar (Demonstrator in Entomology).

It is with deep regret that the Council have to record the death of Dr. William Brodie, of Toronto, who died on the 6th of August last, in his seventy-eighth year. He had recently been contributing a series of papers on Gall insects to the pages of the "Canadian Entomologist," and was occupied with the duty of looking after the collections in the Museum of the Department of Education. One of the oldest honorary members of the Society, Mr. William H. Edwards, died in the early part of the year. He had been one of the most regular contributors to the pages of the "Canadian Entomologist" during a long series of years and was known to the scientific world as the author of three most beautifully illustrated volumes on "The Butterflies of North America." We have also to deplore the loss of another contributor in the person of Prof. M. V. Slingerland, of Cornell University. Obituary notices of these gentlemen have already been published in the pages of the "Canadian Entomologist."

Efforts are now being made to hold an International Congress of Entomologists at Brussels, in August of next year. A large Committee has been formed to represent the Dominion of Canada, including members of our Society in all the different provinces. It is much to be hoped that we may be represented by one or more delegates, and that the forthoming meeting may be a precursor of a long series in years to come.

It is with much regret that the Council has learned that the Rev. Dr. Fyles, for so many years the active President of the Quebec Branch, has resigned his position as Chaplain to the Immigrants and removed to Hull, P.Q. The rest and retirement which he has so well earned by many years of laborious work will, it is hoped, be long enjoyed by this veteran entomologist. Mr. A. R. M. Boulton has been elected President of the Quebec Branch, which will, no doubt, continue as active and enthusiastic as heretofore.

The Council has great pleasure in welcoming Dr. C. Gordon Hewitt, the newly-appointed Dominion Entomologist for the Experimental Farms. It is a

great satisfaction to know that we have a successor to the late Dr. Fletcher who has had a thorough scientific training and is evidently quite competent to take up and continue the work of his illustrious predecessor. The country is to be congratulated on the acquisition of so able a man and it is trusted that he will long continue to work out and develop the various phases of economic and systematic entomology which will devolve upon him. We welcome him most cordially also to the ranks of our Society.

Respectfully submitted,

TENNYSON D. JARVIS,
President.

REPORT OF THE MONTREAL BRANCH.

The 302nd regular, and 36th annual meeting of the Montreal Branch was held at 74 McTavish Street on May 8th, 1909.

The members present were: Messrs. Geo. A. Moore, in the chair; Henry H. Lyman, G. Chagon, G. A. Southee, E. C. Barwick, A. E. Norris, L. Gibb, F. Parkins, Jr., W. G. Gerth, A. M. Delisle, A. F. Winn.

The minutes of the April meeting and last annual meeting were read and confirmed.

St. Hilaire was selected as the locality for Victoria Day outing.

The Secretary read the following

REPORT OF THE COUNCIL.

During the season eight regular meetings have been held, the average attendance being eight members. Six new names have been added to the roll, and it is hoped that after the collecting season that they will help make our meetings interesting by bringing specimens of their captures as well as notes and queries on certain species.

At the beginning of the present year, the Mount Royal Entomological Club was amalgamated with our Society, their books, pamphlets and funds being handed over to us. To take the place of part of the work of the late club, it was decided to hold informal meetings between the regular dates or during the summer. Two of these meetings have been held: one in January was devoted to examining the collection of lepidoptera of the Secretary: the other in April at Mr. Barwick's, at which he showed his new cabinet and collection, and microscopic slides of insects were exhibited under three of the members' instruments.

The following is a list of the papers read:

Annual Address of President, Geo. A. Moore.
A Supposed Addition to Montreal Lists (Incisalia Henrici), Henry H. Lyman.
More Recollections, H. F. Winn.
Captures of Hemiptera at St. Hilaire, May 24, Geo. A. Moore.
"Go to the Ant, thou Sluggard," Henry H. Lyman.
Two Additions to the List of Montreal Butterflies, A. F. Winn.
Note on Junonia Cœnia in Maine, A. F. Winn.
On Water-Striders, Geo. A. Moore.
Respiration in Caterpillars, Henry H. Lyman.
A Trip to Gardiner, Maine, A. F. Winn.
A Small Collection of Insects from the Yukon, G. Chagnon.
The Genus Triphleps (Hemiptera), G. A. Moore.
Notes on a few Butterflies from the Yukon, Henry H. Lyman.
Notes on Hepialidæ, A. F. Winn.
Unnamed Capsidæ, Geo. A. Moore.

Pseudohazis Shastaensis, A. F. Winn.
The Shores of Ponds and Creeks as Collecting Grounds, G. Chagnon.
Note on Capture of Colias Philodice, var. Luteitincta, A. F. Winn.
A Card-Index Chart for Life Histories of Insects, A. F. Winn.
Butterfly Collecting in Manitoba (selected), Capt. J. G. Boulton, Quebec.
On Spittle-Insects, Geo. A. Moore.
Remarks on Prof. Poulton's Paper on Mimetic Species of Limenitis, Henry H. Lyman.
Structural Characters of Our Species of Agrilus, G. Chagnon.
On Luck, A. F. Winn.

The report of the Treasurer shows a balance on hand of $72.86. The incoming Council are reminded of one or two matters not yet finished, viz., the selection and purchase of a suitable bookplate, the completion of bound sets of the *Canadian Entomologist* for our library, as well as the arrangement of outings for the summer and a programme for winter months.

Respectfully submitted.

(Signed) GEO. A. MOORE, *President.*

The President read the annual address, after which the election of officers was proceeded with, resulting as follows:

President, Henry H. Lyman; Vice-President, G. A. Southee; Secretary-Treasurer, A. F. Winn; Librarian and Curator, L. Gibb; Council, G. Chagnon, G. A. Moore, E. C. Barwick, F. Parkins, Jr.

Mr. Lyman read a paper, entitled, "A Spring Outing," describing a trip to Washington, D.C., and other places, made about April, 1908, illustrating his remarks by specimens of Lepidoptera and pressed plants.

The meeting then adjourned.

(Signed) A. F. WINN, *Secretary.*

REPORT OF TORONTO BRANCH OF ENTOMOLOGICAL SOCIETY FOR 1908-1909.

The thirteenth annual meeting of the Society was held on Thursday, June 10th, 1909, in the Provincial Museum, St. James' Square.

The President, Dr. Brodie, was in the chair, and the following members were present: Miss Blackmore, Mr. Smith, Mr. Miller, Mr. Williams, Mr. Cosens, Mr. Laing and Dr. Abbott.

The following officers were elected for 1909-1910:

President—Dr. Brodie.
Vice-President—Dr. E. M. Walker.
Secretary-Treasurer—Mr. J. M. Laing.
Librarian—Mr. J. B. Williams.
Curator—Mr. J. M. Laing.
Council—Mr. S. T. Wood, Mr. A. Cosens, Mr. T. J. Ivey and Dr. A. R. Abbott.

During the past year meetings were held with an average attendance of eight members. The Society held an excursion to Niagara Glen, which proved both profitable and enjoyable

The membership of the Society is now twenty-seven. During the past winter the tussock-moth and galls have received much attention, as the list of papers appended will show.

The Librarian reports that publications have been received from the Entomological Bureau at Washington, from the Ohio and Connecticut Experiment Stations, and from the New York State Museum; and, as in former years, the Society have subscribed for a copy of the *Entomological News.*

The Treasurer's report shows the finances to be in a satisfactory condition with a balance in hand of $1.35.

Respectfully submitted,

J. M. Laing, *Secretary-Treasurer.*

List of Papers Read: Galls, Dr. Brodie; The Tussock Moth, Dr. Brodie; Collecting in England, Mr. Williams; Galls, Dr. Brodie; Characteristics of the Order Orthoptera Dr. Walker; Insect Mimicry and Evolution, Dr. Brodie; Ferns, Mr. Ivey; The Tussock Moth, Dr. Brodie.

TREASURER'S REPORT.

Receipts.

Balance from 1907-1908	$779 74
Late Treasurer to March 16, 1908	89 25
Back numbers	181 50
Annual Reports	19 25
Refund of salary	33 00
Advertising	12 48
Members' fees	397 62
Interest	7 40
Printing extras	26 70
Supplies, pins, etc.	134 40
Expense: sale of cash-book and case	7 50
Government grant—10 months	666 00
	$2,354 84

Expenditures.

Late Treasurer's Exp., Nov. 16, 1909	$37 60
Printing	1,328 64
Annual Report	111 00
Salaries	200 00
Expenses, Postage, etc.	62 60
Annual Meeting	80 81
Exchange on checks	5 10
Library books and binding	41 51
Supplies, pins, etc.	114 44
Balance	373 06
	$2,354 84

J. E. Howitt, *Treasurer.*

Examined and found correct.

S. B. McCready,
J. W. Crow,
Auditors.

REPORT OF THE CURATOR.

The Society's collection during the last year has been increased by the addition of one hundred and eighteen new specimens. Of these, ninety were contributed by Mr. Charles T. Ramsden, Guantanamo, Cuba; twenty-two by Mr. T. Baird, High River, Alberta, and the rest by friends who do not wish their names published. Mr. Ramsden's contribution consisted of eighty-five specimens of Lepidoptera, chiefly butterflies and Spinx moths, one Orthopteron, three Diptera, and one Hymenopteron. These insects being almost solely exotic species have been placed in a case by themselves. All of Mr. Baird's specimens were moths, principally

belonging to the Noctuidae. These have been distributed among the different cases according to families and genera. The other insects presented consisted of four rare species of moths and two specimens of a rather rare scale insect.

The Society is greatly indebted to the contributors, especially to Messrs. Ramsden and Baird, for their generosity.

While gifts of Lepidoptera and Coleoptera are always welcome, there is great need of properly named species of Orthoptera, Odonata, Hemiptera, Diptera and Hymenoptera, and specimens of these orders are specially solicited from members or other collectors.

The collection has been thoroughly inspected from time to time and precautions taken to prevent loss from museum pests or from other causes. They are all in good condition and show no signs of deterioration.

Respectfully submitted,

L. CAESAR, *Curator.*

REPORT OF THE LIBRARIAN.

During the year closing September 30, 1909, twenty-nine bound volumes have been added to the library, making the total number on the register exactly two thousand. There are also a very large number of periodicals, pamphlets and bulletins added to the shelves, many of which, it is hoped, will be bound during the next few months. No new book of any very great importance has appeared during the past year. Several parts of Wytsman's "Genera Insectorum" have been purchased and others will be added from time to time. Forty-three volumes have been taken out by members during the year, and the books have been largely used for consultation by students and members of the Society almost daily during the College terms. Recently the work of making a card catalogue has been resumed and will be carried on steadily throughout the winter. It is expected that a complete catalogue both of subjects and authors will be accomplished by the annual meeting next year. This will render the books in the library much more accessible and useful to the members.

Respectfully submitted,

CHARLES J. S. BETHUNE, *Librarian.*

REPORT TO THE ROYAL SOCIETY OF CANADA.

BY ARTHUR GIBSON, DELEGATE, OTTAWA.

I have the honour to report that the Entomological Society of Ontario has had a most successful year during 1908. It was with very great regret, however, that we had to record the death of our beloved friend and president, Dr. James Fletcher, which occurred at the Royal Victoria Hospital, on Sunday morning, November 8th, 1908.

The forty-fifth annual meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, November 5th and 6th last. An interesting discussion took place at the first session on the chief insect pests of the

season. The annual report of the Society which recently appeared contains a full account of the proceedings, with the papers presented at the meeting published in full. This is a report of 152 pages and is one of the most valuable ever published by the Society. Among the papers which are here printed, the following may be mentioned:

The Interpretation of Nature. By E. P. Felt, Albany, N.Y.

The Economic Importance and Food Habits of American Gall Midges. By E. P. Felt, Albany, N.Y.

Observations on the Sorghum Midge. By R. C. Treherne, Ontario Agricultural College, Guelph.

Hydroecia Micacea, Esp. in Canada. By Arthur Gibson, Central Experimental Farm, Ottawa.

Further Notes on the Coccidae of Ontario. By Tennyson D. Jarvis, O. A. College, Guelph.

Some Enemies of Ontario Coccidæ, By J. W. Eastham, Ontario Agricultural College, Guelph.

"Some Beetle Haunts," by an Amateur Botanist. By F. J. A. Morris, Trinity College School, Port Hope.

A Catalogue of the Gall Insects of Ontario. By Tennyson D. Jarvis, O. A. C., Guelph.

Entomological Record, 1908. By James Fletcher and Arthur Gibson.

Insects of the Year 1908 at Ottawa. By Arthur Gibson, C. E. F., Ottawa.

Present Condition of the Work Connected with the Importation of the Foreign Parasites of the Gipsy Moth and Brown-tail Moth. By L. O. Howard, Washington, D.C.

What Entomology the Farmer and Fruit Grower should know. By Wm. Lochhead, Macdonald College, Que.

Injurious Insects in Ontario in 1908. By C. J. S. Bethune, Ontario Agricultural College, Guelph.

Injurious Insects of uebec in 1908. By William Lochhead, Macdonald College, Que.

The Farmer's Wood Lot. By Rev. Thos. W. Fyles, Levis, Que.

Life History of Euchætias Oregonensis, Stretch. By Henry H. Lyman, Montreal.

The Society's branches at Quebec, Montreal, Toronto, Guelph and Vancouver all report a most active year. They have all held regular meetings at which papers have been read and specimens exhibited for discussion. The British Columbian Branch publishes a Quarterly Bulletin, which gives concisely the work of the local members. Valuable notes on captures are included from time to time.

The library of the Society, at its headquarters in Guelph, is continuously growing. During the year ending August 31st, 1908, 49 bound volumes were added to the Library, making the total now on the register 1,971. The books of the Society are consulted almost daily by members and also to a considerable extent by the students of the Ontario Agricultural Society.

Some interesting donations have been made during the year to the Society's collections of insects. These collections are now being gone over and many old specimens have been replaced by fresher examples, bearing fuller particulars as to locality, date of collection, etc.

The *Canadian Entomologist*, under the continued able editorship of the Rev. Prof. C. J. S. Bethune, completed last December its fortieth volume. This is a much larger volume than usual, containing 471 pages. Its articles are of the greatest value to entomologists, in fact it is absolutely necessary for anyone who studies insects to any extent, to subscribe to it. Sixty-nine different entomologists contributed to its pages last year, and a number of full page plates appeared as well as numerous figures in the text. It is impossible here to give a list of the papers published, but the following are some of the more important:

British Columbia Syrphidæ, New Species and Additions to the List. By Raymond C. Osborn, Columbia University, New York.

New Histories and Species in Papaipema (Hydrœcia). By Henry Bird, Rye, N.Y.

Studies in the Genus Incisalia. By John H. Cook, Albany, N.Y.

ADDRESS OF THE PRESIDENT.

By Tennyson D. Jarvis, Ontario Agricultural College, Guelph.

It is my happy privilege to preside over the present meeting and very thankfully do I accept the position which you have so kindly imposed upon me. I have the peculiar privilege of succeeding the late lamented Dr. Fletcher, whose labours and abilities need no words of praise or encomium from me, as they are so well known and so thoroughly familiar to you all.

Besides the late Dr. Fletcher, who so eminently strove to advance the interests and welfare of this Society, we also most sincerely deplore the loss of the activities in our behalf of the late Dr. Brodie, of Toronto. In the neighbouring States William Ashmead, Prof. Slingerland and W. H. Edwards have departed since our last meeting, and the entomological world suffers an immeasurable loss. The results of their untiring zeal and labours to discover what we might know, and what we should know, of the science of entomology have impressed their effects deeply and indelibly upon the minds and in the hearts of all students of this extensive and intricate science.

In the interests of entomology I must congratulate this Society and the country at large on the arrival of Dr. C. Gordon Hewitt, of England, now active at the Central Experimental Farm at Ottawa, and one whose reputation for good work in scientific and economic Entomology had preceded him to this country. Since the decease of the late Dr. Fletcher the department over which he presided has been divided, the Entomological division being taken charge of by Dr. Hewitt, ably assisted by Mr. Gibson, and the Botanical division by Mr. H. T. Gussow, assisted by Mr. Groh.

I regard with pleasure the many new and effective methods which have arisen and have been adopted during the past few years for the diffusion of the know-

ledge of the science of Entomology. The work of the agricultural experts attached to High Schools in several counties of Ontario, will give a great stimulus to the study of Entomology. The office of the experts includes the teaching of the science in the high school, the conducting of experiments in farmers' orchards and elsewhere, giving advice on agricultural matters and establishing libraries in each county which will contain work largely devoted to Nature Study. Teachers of high and public schools have taken up the subject with more or less success and their work has been very prolific of good results. Another method, and one which may in course of time be a most powerful one to increase the study of entomology, is the three months' course at the Ontario Agricultural College for Normal School students. Nearly two hundred students have during the past year availed themselves of this opportunity, and the number promises to be largely increased in future years.

There is also the nursery and orchard inspection conducted through the horticultural branch of the Department of Agriculture by which an intimate knowledge of injurious forms of insects is obtained and remedies are applied to prevent their increase and spread through infected fruit or stock. The Natural History Societies, with their publications on Nature Study, their excursions, their periodical meetings where eminent scientists are frequently invited to address the members, and in many other ways, have made great strides forward in obtaining and diffusing the knowledge of insects. Another attractive method for the enlightenment of the farmer, nurseryman and others upon this subject of insects, is found in the bulletins issued from time to time by experimental stations and agricultural colleges, by which the quintessence, as it were, of the subject is brought to easy view within a few pages of reading matter. I must also acknowledge the good work of the *Farmer's Advocate, Canadian Horticulturist,* and the *Weekly Fruitgrower* for their assistance in the diffusion of knowledge and the instruction of their readers. These periodicals merit highly the splendid patronage accorded to them.

From the position which I at present occupy I feel impelled to acknowledge that a large share of the means of disseminating a knowledge of the workings of our Society throughout the world is due to the *Canadian Entomologist,* our monthly magazine edited by Dr. Bethune. This publication has long since attained a position of celebrity in literary and scientific circles for the thorough information it imparts and the high standard of excellence it has attained and achieved.

The graduates from this College in the Department of Biology also deserve to be mentioned as a potent factor in the gathering of facts and diffusing knowledge in this science. Their studious and untiring researches and investigations, the zeal and energy with which they enter into their task, and the interchange of ideas resulting from them have greatly assisted in attaining a thorough knowledge of certain families of insects under all kinds of climatic conditions.

We should not overlook the work of this College and of kindred institutions in the diffusing of the knowledge of Entomology and the stimulus they impart to research. Hundreds of students therein, undergraduates, are during the most favourable season of the year engaged in the gathering of insects and in the study of their life histories, their habits and their workings.

A great deal is done for the spread of information regarding insects by the professors at the Colleges where the science of Entomology forms part of the curriculum, by correspondence with people of various pursuits making inquiries. There have been many hundreds of such enquiries answered during the past year by Dr. Bethune of this College, and his colleagues, and no doubt the same may be said respecting the correspondence in other Colleges of a similar character.

The lectures given by professors and graduates of Agricultural Colleges, and by others who have given the matter thought and study, upon all branches of Nature Study at meetings and gatherings of various kinds, also greatly assist in disseminating in a more or less successful way, the knowledge of this science and the useful application of what we know about insects.

Among some of the latest and best works upon the subject of insects published during the past year may be mentioned "Our Insect Friends and Enemies," by Dr. J. B. Smith; "Insects and other Allied Pests, etc.," by Fred V. Theobald; and "Fruit Trees and Their Enemies," by Spencer W. Pickering.

It is to be regretted that in the cause of research the methods employed are not always calculated to bring about the best possible results. Persons engaged in this work are often too easily contented with the discovery of individual insects and fail to profit by the study of a family group of them. In this regard the pursuit of research should be continued with more and better system and it would be well to inculcate into the minds of all entomologists that this science must be studied, not from individual insects alone, but also from observing the life history, the habits, the qualities and working of whole families. However, the proper methods have been adopted by a number of eminent scientists in this country and the United States as we learn from the reports of their successful researches.

It is to be hoped that the governments of the day will be as generous, or even more so, in giving aid for the benefit of the science of entomology as they have been in the past, so that the work or research and the diffusion of information may not suffer from want of the means to carry them on. When able men, aided by the necessary means, are active, great results may be expected, and with the stimulus of new discoveries constantly before them, there is no fear that we should suffer disappointment; the benefits to our country and its people derived therefrom, will in all probability be equal to, if they do not surpass, any investment of energy and means in other causes.

In closing my remarks I desire to thank you very heartily for your attendance here, for the excellence of your addresses, and the patience and close attention you have exercised during this meeting. If the enthusiasm for the science of entomology which you have displayed during this session is a true exponent of the spirit within you, it augurs well for profitable and successful years to come for the Entomological Society of Ontario.

THE ORIGIN AND DIFFUSION OF ENTOMOLOGICAL ERRORS.

BY HENRY H. LYMAN, MONTREAL, QUE.

Though using the word entomological, I shall confine my remarks to the Lepidoptera as the only order which I have studied, but doubtless similar conditions have given rise to similar errors in the other orders.

Anyone who has looked over many collections of North American Lepidoptera must have been struck by the number of mis-identifications of species, or transpositions of names to be found in them, and an interesting study could be made of the numerous popular errors which have become current in time past, and which in many cases still persist. Indeed, their universality and persistence is quite remarkable and it seems almost hopeless to try to eradicate them.

Their origin can in most cases only be surmised, but their diffusion and persistence can be easily accounted for. In Europe they have always been much better supplied with illustrated works on Entomology than we have been on this continent, and this is easily accounted for. In the first place the science was studied there long before it was here and many North American insects were described by European authors. Then there has always been a much larger number of collectors in Europe than in America, and if many of them have done nothing else to advance the science, their subscriptions have at least rendered possible the issue of well illustrated works, which was also assisted by the much cheaper rate at which such works could be produced in Europe than in America.

The earliest important work devoted to the Lepidoptera of North America was the magnificent work by Abbot and Smith in two large folio volumes on "The Natural History of the Rarer Lepidopterous Insects of Georgia," which was published in London in 1797, but this was a costly work and only found its way into the more important libraries and to a few wealthy collectors.

Thomas Say, who has been called the Father of American Entomology, wrote between 1818 and his death in 1834, but it was only in 1859 that his complete writings on Entomology were collected by Dr. John L. Leconte, and issued in two volumes. Of the 54 coloured plates, only 12 were devoted to the Lepidoptera, most of the others being given to the Coleoptera. In 1841 appeared the first edition of Dr. Harris' classic work on the "Insects of Massachusetts Injurious to Vegetation," and other editions were issued in 1842 and 1852, and the revised edition by Flint in 1861. But from none of these works could the names of more than a very few of the moths of this continent be learned, and, therefore, collectors were dependent upon the leading authorities in the various branches for the determination of their captures.

As Mr. Grote was the leading authority upon the Noctuidæ, he was probably the one most frequently appealed to for determinations, indeed, he once advertised that as his time was so much taken up with this work he would for the future make a charge for naming specimens, which probably had the effect of materially reducing the applications.

Another who did a great deal of this work was Dr. Herman Strecker, who advertised his readiness to determine material sent him.

Under such conditions it can be easily understood that mistakes would be sure to arise. In many cases duplicate specimens would be numbered and sent for name, corresponding numbers being placed on other specimens, which were retained by the collector. Unless specimens were rare, their return would often not be asked, in order to avoid the return express charges, but a list with numbers and the names would be returned.

Mistakes might happen in many ways. As has been said, "no one is infallible, not even the youngest of us," and these high authorities would certainly have some errors in their collections, and so name these species wrongly for others. Again, in handling the specimens, the numbers of a couple might drop off and then be accidentally transposed in replacing them, and this might occur either in the hands of the one who named, or the collector who sent them. Or the collector might make a mistake and think two closely allied forms the same and send one for name, while retaining the other as his numbered specimen.

Given an initial error, its spread would be inevitable. John Brown, who had had his specimens determined by so high an authority as the celebrated Dr. Blank, would at once become an authority among those of his acquaintance whose specimens have not been so authoritatively determined, and these collectors would be

only too willing to have him name their specimens for them, and these in turn corresponding and exchanging with others would still more widely diffuse the error.

One error which has become very widely diffused is the transposition of the names "Gortyna nitela Guen." "Gortyna nebris Guen."

The author of those names described *nebris* first mentioning the white spots and then in the description of *nitela* wrote: "Taille et couleur de la *Nebris,* dont elle ne diffère que par l'absence complète des taches blanches," and yet in most collections the white marked one is called *nitela* and the one without white spots *nebris.*

Another common error is the transposition of the names *petulca* and *ferrealis* in the genus Xylina, which was current in all our Montreal collections from the time that Grote and Strecker were naming material for the late Mr. Caulfield, until I discovered the transposition when studying the genus a few years ago.

That that error must also have been widespread may be inferred from the fact, pointed out by Dr. J. B. Smith, that Dr. Holland figured *ferrealis* under the name *petulca.*

Of course, an error could not become almost universal unless some prominent authority were himself in error, and that has undoubtedly frequently been the case.

Dr. Scudder's writings afford several curious instances of this. In 1863 he published in the Proceedings of the Essex Institute of Salem, Mass., "A list of the Butterflies of New England," in which he describes as new *Melitæa Œnone* and *Melitæa Harrisii,* the latter being the species which Harris had placed hesitatingly under the name Melitæa Ismeria, Boisd. and Lec. Subsequently he ascertained by comparison of his *Œnone* with types of M. Nycteis, Doubl, and he had redescribed the latter species, so in his "Supplement to A List of the Butterflies of New England," published in Proc. Bos. Soc. Nat. Hist. XI., 1868, he corrected his error in regard to it, but in some way which he was never able to explain, made another error in saying that *M. Ismeria?* Harris was a synonym of Nycteis and not of M. Harrisii Scudder. In his magnificent work on the Butterflies of New England he made three transpositions. On plate 3, he transposed the numbers of the figures of *Grapta Interrogationis* var. Umbrosa and var. Fabricii, this he corrected in the appendix. On plate 10, he transposed the numbers of what he called Atrytone Zabulon male and female, but which is really Hobomok, and to this I called his attention, and in his third volume, in the part devoted to butterflies not found in New England, he transposed the descriptions of Brenthis Freija and Chariclea.

More recent examples of curious transpositions are well known to most of us occurring in Holland's beautiful "Moth Book," and these, unfortunately, will have a wider effect on account of the thousands who will use the book, not one in ten of whom will ever see the corrections which have been published.

Another class of errors is composed of those which have a purely typographical origin. A curious one of this kind, which, however, has no importance, occurs in a paper by C. E. Worthington, formerly of Chicago, Ill., entitled "Notes on Argynnis Alcestis." (Can. Ent. X. 38.) After saying that both Alcestis and Aphrodite were found in the neighbourhood of Chicago, but generally at different localities, he says: "I have been greatly surprised at the readiness with which a strong *aphrodite* upon the prairie can be distinguished, while on the wing from the surrounding *alcestis,* etc.," and I feel sure he wrote "stray," but that it was misprinted "strong." and this error was reproduced by Edwards in his magnificent work on the "Butterflies of North America."

More serious errors of typographical origin, or perhaps merely through careless transcription, are those in connection with names.

CORRECTIONS OF ERRORS IN HOLLAND'S MOTH BOOK.

Plate.	Fig.	Name Given.	Should Be.	Correction By.	Publication.
vi.	1	*Cocytius antæus, Dru*	*C. cluentius Cr.* ♂	E. A. Smyth, Jr.	*Ent. News*, xv., 105.
xvi.	9	*Hyphantria cunea*	*H. textor*, as in text	H. H. Lyman	
xvii.	23	*Euthisanotia grata*	*E. unio*	E. J. Smith	*Ent. News*, xvi., 88.
	24	" *unio*	*E. grata*	"	"
	16	*Alypia Langtoni* ♂	*A. octomaculata*, as in text	H. H. Lyman	
xviii.	14	*A. lepusculina*	*A. populi*, as in text	"	
	16	*A. Radcliffei*	*A. albarufa*, as in text	"	
	24	*A. xyliniformis*	*A. lithospila*, as in text	"	
xxiv.	34	*Heliophila albilinea*	*H. diffusa*	E. J. Smith	*Ent. News*, xv., 221.
xxv.	9	*Xylina petulca*	*X. ferrealis*	J. B. Smith	*Ent. News*, xv., 104.
xxvi.	5	*Papaipema inquæsita*	*P. impecuniosa*	E. J. Smith	*Ent. News*, xv., 221.
	8	" *nebris*	" *nitela*	"	"
	9	" *nitela*	" *nebris*	"	"
xxix.	66	*Cydosia majuscula*	*Tricostibas calligera*	H. G. Dyar	*Can. Ent.*, xxxvi., 26.
xxx.	15	*Drasteria crassiuscula*	*D. erechtea*	E. J. Smith	*Ent. News*, xv., 221.
xxxi.	4	*Catocala subviridis*	*C. Agrippina*	Wm. Beutenmuller	*Can. Ent.*, xxxvii., 292.
	8	" *retecta*	*C. luctuosa*	"	"
	11	" *flebilis*	*C. Angusi var. lucetta*	"	"
	14	" *obscura*	*C. residua*	G. H. French	*Can. Ent.*, xxxvi., 54.
xxxii.	5	*C. dejecta var. Carolina Holl.*	*C. flebilis*	Wm. Beutenmuller	*Can. Ent.*, xxxvii., 292
	6	*Catocala relicta*	*C. relicta var. clara*	"	"
	7	" " *var. bianca*	*C. relicta*	"	"
xxxiii.	1	" *Californica*	"Looks like a pale C. Irene"	"	"
	4	" *Ultronia var. Celia*	*C. Ultronia var. Adriana*	"	"
xxxiii.	7	*Catocala Ultronia var. mopsa*	"Not *mopsa*, but another var."	"	"
	8	" *Augusta*	"Looks like *C. Californica*"	"	"
xxxiv.	7	" *ilia var. osculata*	"Looks like *C. ilia*"	"	"
xxxv.	1	" *amasia*	*C. sancta*	"	"
	2	" *similis*	*C. similis var. aholah*	"	"
	3	" " *var. aholah*	*C. similis*	"	"
	5	" *fratercula var. jaquenetta*	"Looks like *C. blandula*"	"	"
	7	" *præclara*	*C. gracilis var. sordida*	"	"
	13	" *Stretchii*	*C. Mariana*	G. H. French	*Can. Ent.*, xxxvi., 54.
	14	" *Californica var. Cleopatra*	"Looks like *C. Californica*"	Wm. Beutenmuller	*Can Ent.*, xxxvii., 292
	15	" *Rosalinda*	Looks like *C. Californica var. Cleopatra*	"	"
xlii.	32	*Tephroclystis absinthiata*	*Macaria infimata*	H. G. Dyar	*Can. Ent.*, xxxvi., 26
	25	*Paleacrita vernata*	*Alsophila pometaria*	G. W. Taylor	*Can. Ent.*, xxxvi., 245.
	49	*Mesoleuca intermediata*	*Petrophora fluctuata*	"	"

CORRECTION OF ERRORS IN HOLLAND'S MOTH BOOK.

Plate.	Fig.	Name Given.	Should Be.	Correction By	Publication.
xliii.	10-11	*Hydriomena custodiata*	*Hydriomena excurvata*	H. G. Dyar	*Can. Ent.*, xxxvi., 26.
	36	*Deilinia variolaria*	*Deilinia erythremaria*	G. W. Taylor	*Can. Ent.*, xxxvi., 245.
	39	*Philobia enotata*	*Philobia notata* (of Europe)	"	"
xliv.	2	*Caripeta angustiorata*	*Caripeta seductaria*	"	"
	32	*Plagodis emargataria*	"I think *P. alcoolaria*"	"	"
xlvii.	15	*Euclea chloris*	*E. indeterminata*	H. G. Dyar	*Can. Ent.*, xxxvi., 26.
	21	*Cochlidion y-inversa*	*Tortricidia flexuosa*	"	"
	27	" *rectilinea*	*C. latomia*	"	"
xlviii.	22	*Tortrix albicomana*	"Is very unlike the type"	W. D. Kearfott	*Ent. News*, xv., 105.
xlviii.	24	*Platynota flavedana*	*Olethreutes nimbatana*	"	"
	40	*Epagoge tunicana*	"Probably *Sparganothis sencionana*"	"	"

Corrections to the "Key to the Families," supplied by Dr. H. G. Dyar.

Page 24: Under 3, for 15 read 14. Under 14, for 17 read 16.

Page 25: Under 25 add a line, "Fore wing with vein 5 nearer to 4 than to 6 26." Under 26, for 26 read 27.

On page 62 the reference after Hæmorrhagia thysbe should be to Plate II., not I.

On page 337 Epelis faxoni Minot is referred as a synonym of Epelis truncataria Walk. E. J. Smith, *Ent. News*, xv., 221, says erroneously.

Page.	Text. Fig. Named.	Should Be.	Correction By.	Publication.
378	*Inguromorpha basalis*	*Cossula magnifica*	H. G. Dyar	*Can. Ent.*, xxxvi., 26.
379	*Cossula magnifica*	?	"	"

In *Ent. News*, xv., 105, W. D. Kearfott says, "Several of the generic names used by Dr. Holland differ from those used in Prof Fernald's latest published list of Pyralids, Zinckenia Zell. for Hymenia Hbn., Glyphodes Gn. for Diaphania Hbn., Phlyctænodes Gn. for Loxostege Hbn., and he has repeated the error which occurs in both Dyar's Catalogue and Smith's 1903 List, Alceris in place of Acleris."

Most collectors know the pretty moth named *Plusia Ærea,* Hubn, and the one so much like it that it was named *Æreoides* by Grote. The name of the latter was correctly printed up to the issue of Dr. Smith's Catalogue of Noctuidæ in 1893, in which it appeared cut down to Æroides, but whether through the error of author or printer, I am unable to determine, and since then I have hardly ever seen it correctly spelled anywhere. Dr. Dyar fell into the same error in his catalogue of 1902, though he gave the correct spelling in his index, and Dr. Smith, in his check list of 1903, repeated the error, and everywhere the same erroneous spelling is copied, including publications issued by Dr. E. P. Felt, State Entomologist of New York, and in the lists of British Columbian Lepidoptera recently issued.

In order to render my copy of Dr. Holland's Moth Book as correct as possible, I have tabulated the corrections which have been made from time to time in different publications by different writers, and have myself discovered five discrepancies between names on plates and in the text. If any corrections have been made which I have not noticed, or if any of the corrections have been proved erroneous, I would greatly appreciate being informed of the facts.

CONFLICTS BETWEEN ANTS.

By G. E. Sanders.

Following are notes on a series of conflicts between two species of ants—*Myrmica scabrinodes sabuleti, Meinert,* and *Lasius niger Americanus*:

While making night observations on the Corn-root ant, *Lasius niger Americanus,* in August, 1909, Mr. W. P. Flint and myself accidentally caused a very curious conflict between the workers of a Lasius nest, and those of a nest of Myrmica. For the three nights following we were fortunate enough to have it repeated and to get several variations in the original procedure of Myrmica. It is on these variations in the actions of Myrmica that I intend to dwell particularly, and I will leave it to the reader to decide as to whether we had an unusual series of accidental happenings, or if Myrmica is endowed with a certain amount of reason.

To describe the situation:—The Lasius nest, containing about 250 workers, was situated under the edge of a wide furrow which we had plowed through a corn field; the furrow was 6 inches deep, and the bottom of it cleaned out with shovels, leaving a smooth surface, one foot in width. The Myrmica nest, containing about 60 workers, was situated in the bottom of this furrow, about 8 inches away from the opening of the Lasius nest; 6 inches beyond this, and in the bank opposite the first Lasius nest, was a second Lasius nest, containing about 150 workers.

Both species of ants are for the most part nocturnal, at least in their movements on the surface. During warm nights throughout the summer one will find from 1-10 to 1-4 of the workers of a Lasius colony on the surface, foraging within two feet of the entrance to the nest; a few individuals forage at greater distances, but the majority forage near the nest. This enables them to attack and kill, by force of numbers, almost any small insect, up to the size of the common Carabid, *Agonoderus pallipes,* which is unfortunate enough to fall among them. They exhibit great courage and skill in attacking these insects, which are often 12 to 15 times as heavy as a Lasius worker. Myrmicas seldom forage near their nest; they forage

singly at great distances, often 10 feet from the nest, and seldom attack living insects. It often happens that a Myrmica, in foraging, will wander into a migrating line or band of Lasius foragers. Several Lasii will immediately attack it, one holding to each leg or *antenna*, and will drag it from the vicinity of the nest or line, as it happens to be, and there leave it to go as it will, making no attempt to kill it. The Myrmica, in such cases, offers no resistance whatever, and will remain almost motionless while being dragged away. Occasionally a solitary Myrmica and a solitary Lasius will meet, and while the Lasius will usually avoid the Myrmica, it will sometimes attack the larger ant. In such cases the Myrmica will stand higher in the air than usual, moving about slowly, keeping the Lasius, which is attempting to get a hold on its legs or antennæ, a little to one side and slightly in front of its head. They will often fence in this manner for a minute or more until the Lasius gets in the proper position, when the Myrmica, with a spring, swifter than one would imagine such an ungainly ant capable of, will seize the Lasius, usually by the petiole from the upper side, and lifting it in the air, will carry it to the nest, possibly for food.

Myrmica, while a very sluggish and awkward ant, shows itself in cases such as the two mentioned (and probably 100 of each were observed during the summer), to be a very cool, deliberate, and, if such a term may be used, calculating ant. Lasius moves more quickly, and apparently more blindly than Myrmica.

On the night of August 18th and 19th, while feeding the foragers about the larger Lasius nest, some of the food insects dragged themselves near the opening of the Myrmica nest before they were overpowered. In the excitement of capturing the insects, 75 to 100 Lasius had come out from their nest and were busily engaged near the Myrmica entrance in dragging the dead insects back to their own nest. At this moment a single Myrmica appeared at the opening of its nest, and in a second disappeared. In less than a minute three more Myrmicæ appeared and after running about on the surface for a few seconds in an excited manner, disappeared into their entrance. A few seconds later the whole colony of Myrmicæ, with the queen, came pouring from their nests, many of them carrying young, and very evidently prepared to migrate. A few of the Myrmicæ attacked the Lasii nearest them, while the rest ran about aimlessly for a few seconds, and then returned the young to the nest. The majority of the Myrmica workers now began an earnest attack on the Lasii, driving them slowly away from the insects which they had captured, and in the course of 15 minutes had them all driven back into their nest, leaving the insects near the Myrmica nest where they had abandoned them. The queen Myrmica remained on the surface only a few moments after the young were returned to the nest; she did not go more than three inches from the entrance and took no part in the battle.

After the Lasii had all been driven in, most of the Myrmicæ returned to their nest, leaving about 20 of their number, apparently standing guard, about the Lasius entrance, where they remained for some time, the last ones leaving and returning to their own nest about twenty minutes after the last Lasius had disappeared. The Myrmicæ in returning to their nest scarcely noticed the dead insects, two of them dragged a dead back-swimmer about for a moment and abandoned it. The remains of the insects were found at their entrance the next morning, showing that during the night they had dragged them in and devoured them.

On the night of August 19th-20th, the Lasii were brought near the Myrmica nest by feeding with living insects, this time purposely. The Myrmicae in appearing on this night were somewhat less excited than on the previous night,

most of them attacking the Lasii as soon as they emerged from the nest. A few young, less than ten, were brought to the surface, as they emerged, and immediately returned to the nest. The queen remained in the nest throughout this battle. The time occupied in driving the Lasii into their nest was about fifteen minutes. After they were driven in, a number of the Myrmicæ—about 20—remained at the entrance as before, the last of them leaving the entrance fourteen minutes after the battle proper closed.

On the night of August 20th-21st, the Lasii were enticed out near to the Myrmica nest in the same manner as before. Their presence was discovered by two Myrmica workers which alarmed the nest. The Myrmicæ, in appearing on this occasion, did not bring their young with them, but among the last of the ants which came pouring from the entrance, the queen appeared. The Lasii were at once attacked and driven away from their captures and in about fifteen minutes were all driven into their entrance. The queen Myrmica remained on the surface not more than two minutes; her presence there was probably accidental. It is possible that she was caught in the swarm of workers emerging and carried along with them. She took no part in the battle, not going more than an inch from the entrance to her nest. The Myrmicæ on this night did not remain at the Lasius entrance more than two minutes after the last Lasius had disappeared.

On the night of Aug. 22nd-23rd, the drawing out of the Lasii and the emergence of the Myrmica workers was exactly the same as on the previous nights, excepting that the queen did not appear. No young were brought to the surface by the Myrmicæ on this occasion. The Lasii were driven from their food and into their nest in approximately the same time as on the two previous nights. After the Lasii had all disappeared the Myrmicae scarcely remained at their entrance at all, returning to their own nest almost immediately.

On the night of Aug. 23-24th we had an exact duplicate of the proceedings of the previous night, until the battle was well under way, when we drew out the second and smaller nest of Lasius. By using insects which they were particularly fond of we drew them up to the rear of the line of fighting Myrmicae, about as near the Myrmica nest as the first nest of Lasius had been when the Myrmicae attacked them. When this second nest of Lasius came near so that the Myrmicae began to notice them the last of the large nest of Lasii were disappearing. The appearance of this second nest seemed to demoralize the Myrmicæ, which were already in some disorder, and instead of attacking, as we expected they would, most of them ran around the cluster of Lasii and disappeared into their nest; a few of them attacked the Lasii, but not being supported, fell off and returned to the nest, leaving the second nest of Lasius in full possession of their insects, which they dragged to their nest.

On account of the nights becoming suddenly colder, we could not get Lasius to come out, and so had to discontinue the observations. One of the most curious things was the apparently regular battle formation of Myrmica. In every case, soon after the conflict began the Myrmicæ would form in a somewhat irregular line, with only a few workers behind, and a few in front of this line, those behind fighting with the straggling Lasii, and those in front being attacked by several Lasii and seldom moving, simply allowing the Lasii to pull at them. The line was always thickest at the centre, and thinnest at the ends where the Lasii were least numerous. The ends in all cases advanced faster than the centre, so that towards the end of the battle the line would assume the shape of a horseshoe. On the night of the 23-24th when we brought up the second nest of Lasii behind this apparent formation, which was already partially broken up in driving the

first nest of Lasius into its entrance, the Myrmicæ apparently did not know what to do. A few put up a weak fight and in a few moments all retreated, leaving the Lasii in possession of their insects right at the Myrmica entrance. There were plenty of Myrmica workers out to drive off the Lasii, for there were not nearly as many of the second nest out as there had been of the first. Does this indicate that the Myrmicæ fight in a more or less regular formation, and being surprised when this formation was broken up, they retreated rather than fight?

Another thing: On the night of August 18-19th, when the Myrmicæ were first disturbed they brought all of their young to the surface with them. From having seen dozens of Myrmica migrations, we can say positively that they were fully prepared to migrate. On the second night we find only a few young brought to the surface and immediately returned, showing them to be less excited over the presence of Lasius than on the previous night. On the third, fourth and fifth nights no young were brought to the surface at all. It was fear that induced them to bring their young to the surface the first night; on the second night we find that fear greatly abated, as fewer young were brought to the surface and kept there for a much shorter time. On the third, fourth and fifth nights we find no young brought to the surface; so, evidently, they had no fear of their nest being raided by Lasius. Can we conclude that this nest of Myrmica was profiting by experience? It certainly was showing a degree less of alarm over the appearance of Lasius after each successive conflict.

Again, on the first night of the battle, the Myrmicæ stood about the entrance of the Lasius nest for 20 minutes after the last Lasius had disappeared. Whether they were simply wondering where they had gone, or, whether they expected them back, and so were picketing the entrance to prevent their reappearance, we cannot say. On the second night we find them waiting about this entrance for less than 15 minutes. On the third night we find them waiting less than two minutes, and on the fourth night, scarcely waiting to drive the last Lasius in. Does this indicate that they slowly proved to themselves the futility of waiting; that they remembered their earlier experiences, and so did not wait at all on the night of the 22-23rd?

The notes on these conflicts were taken at the same time, separately by Mr. Flint and myself, and later compared. The notes on the behaviour of Myrmicæ, when in ordinary conflicts with the Lasius, are from hundreds of observations, and go to show the cunning of the Myrmica in battle.

The questions which I am not attempting to answer, are those which suggested themselves to Mr. Flint and myself when taking the notes.

THE SPRUCE BUD-WORM, TORTRIX FUMIFERANA, CLEMENS.

By Arthur Gibson, Chief Assistant Entomologist, Experimental Farm, Ottawa.

During the early part of the past summer the Spruce Bud-worm was especially abundant in Canada. Towards the end of July the Deputy Minister of the Department of Agriculture was informed by the Hon. Senator Edwards that some kind of an insect was doing much damage to spruce and balsam trees in the above district, and as a consequence I was instructed to proceed at once to the infested locality, to investigate the outbreak.

Early on the morning of July 29th, therefore, I left Maniwaki, Que., in company with Mr. M. Boyle, of the W. C. Edwards Company, and drove to Baskatong, about 40 miles due north, which place we reached about 5.30 in the afternoon. Around Baskatong the injury to spruce and balsam was very apparent, owing to the conspicuous reddening of the tops of the trees. Early the following morning we left Baskatong and spent the whole day examining trees at different points. As soon as the first tree was cut down I saw at once that a lepidopterous insect had been at work. Thousands of the empty pupal cases of the moths were present on the trees, and these, with the partly eaten and discoloured dead foliage, together with the excrement from the caterpillars, gave the conspicuous reddish appearance to the tops of the trees. The injury for this year, of course, had stopped before the time of my visit. The caterpillars had evidently become full-grown during the first and second weeks of July. Moths which had issued some days before the end of July were present in large numbers on the trees, and from fairly good examples collected, I saw that the species was *Tortrix fumiferana*, Clemens, which is known popularly as the Spruce Bud-worm. The caterpillars had fed chiefly at the tops of the trees, although some injury was done towards the ends of many of the lower branches. The foliage for about four or five feet from the tops of the infested trees was almost wholly destroyed, being either partly or completely eaten by the caterpillars. This, with the exposed pupal cases above referred to, gave the trees the conspicuous reddish appearance, and caused the rather widespread report among lumbermen that the trees were dying. In looking over a valley on the opposite hillside, the trees appeared as if fire had swept through the region. Other than loss of foliage and the consequent setback thus caused, the trees did not seem to be seriously injured. The tops were perfectly green under the bark.

The outbreak of the Spruce Bud-worm this year has been most remarkable and very widespread. Not only has this insect done much damage all through the Upper Gatineau country and other adjacent districts, where there are large tracts of spruce and balsam trees, but even in British Columbia reports have been received of much injury by the Tortrix. Dr. C. Gordon Hewitt, Dominion Entomologist, when in British Columbia, in October last, saw the conspicuous work of the insect and received reports from local entomologists concerning its ravages.

The Spruce Bud-worm, when mature, is nearly an inch in length, tapering slightly from the middle to the end. In colour it is dark brown and bears conspicuous whitish-yellow piliferous tubercles, and along the side of the body there is a yellowish stripe. The eggs of the insect are scale-like and are deposited in clusters overlapping each other. The partly grown caterpillars pass the winter among the terminal shoots of the trees, completing their growth the following year. The moth expands about 7-8 of an inch when the wings are spread. In colour it is dull gray, the fore wings overlaid with bands, streaks and spots of brown. In the middle of the upper margin of the front wings there is a rather large conspicuous whitish spot. In British Columbia, this year, the moths were of a distinct reddish colour, but all the eastern specimens noticed were of the gray form.

When an insect attacks forest trees, such as has been the case with the Spruce Bud-worm the past summer, it is, of course, impossible to do anything in the way of applying remedial treatment, such as is done for leaf-eating insects when attacking orchard or ornamental trees. Fortunately an outbreak of such a nature, however, is generally attended by natural parasites, which sooner or later restore the balance of nature. From observations made, and from parasites reared in

the Division of Entomology from material collected in the Baskatong District, we have reason to hope that the Spruce Bud-worm will not next year continue to any serious extent its work of destruction. Undoubtedly, too, birds will help materially to reduce the numbers of the hibernating caterpillars.

In the forthcoming annual report of the Division of Entomology of the Dominion Experimental Farms, covering the injurious insects of the year 1909, it is purposed to give a much fuller account of the injury done to spruce and balsam trees by the above insects not only in the Upper Gatineau country of the Province of Quebec, but also in British Columbia.

THE SNOW-WHITE LINDEN MOTH.

(*Ennomos Subsignarius, Hubn.*)

BY A. F. WINN, WESTMOUNT, QUE.

Poor as the summer of 1909 has been for most species of butterflies and moths in the neighborhood of Montreal, conditions must have been favourable for this White Geometrid Moth, for during August swarms of them about the electric lamps in our streets attracted the attention of many persons who do not usually take much heed of insects that do not sting them.

For at least twenty years, prior to 1908, the moth might well be considered a rarity and my captures of it in that period did not exceed an average of one specimen per annum, and these were all taken in the woods flying among linden, beech and maple trees. In 1908 there were great numbers of larvæ in June, in the woods at the eastern end of Montreal Island, feeding on the leaves of the trees above mentioned, as well as birch, completely stripping the lower branches of their leaves, the dropping of the frass on the leaves and ground sounding like the patter of a smart shower of rain.

I was out of town the last two weeks of July, during which time the principal part of the flight of the moths occurred, but scores of dead moths in store windows and spider webs, and broken-off wings in little heaps at base of electric light poles and in gutters, showed plainly that the flight must have been one of myriads. The Entomological Record for 1908 tells of the occurrence at Ottawa, July 23rd.: Dr. Felt's 24th Report records its abundance through New York State and Massachusetts, with figures of larvæ and pupæ and plate of eggs and imago; and Mr. W. H. Broadwell in the *Canadian Entomologist* (XL. 327) gives, under title of "A July Blizzard," an interesting account of the flight of swarms of moths at Newark, N.J. The last writer has again an article in the November number of our magazine mentioning that the 1909 crop of moths was even greater than that of the previous year. The same thing has occurred here and doubtless in many other places, and as Mr. Broadwell aptly remarks, it is "very unusual for an insect ordinarily rare to appear in great numbers for two succeeding seasons." If this insect's periods of visit in swarms are always separated by such a long term of years it cannot have many parasites peculiar to itself, or they would surely starve during all the lean years. Toads, bats, cats and sparrows undoubtedly had a sumptuous repast in the cities, but they have quite a choice of diet. It will be

interesting to note whether there are any of the moths next year; if not, we may have to leave future observations to our successors, as the astronomers do with the comets.

On the morning of August 2nd, on my return from a vacation, large numbers of the moths were seen clinging, with their wings closed over their backs, to the office buildings down town, particularly at, or near, the street corners where the arc lamps had evidently attracted them the previous night. The following day there were still some moths about town, and all taken and seen on both days were males.

On August 9th they were again plentiful at the lights during the evening—every lamp passed by in a three-mile walk had its swarm of white moths about it. An incandescent lamp on my gallery attracted many of them, the numbers increasing as it became later, and about 11 p.m. there were often between 20 and 30 flying around and the brick wall of the house was spotted all over with white.

On the 14th, the moths were again noticed down town, in good condition, on walls and windows of buildings and all were males so far as noticed.

On August 24th, after 10 days apparent freedom from them, they were again plentiful and in equally good condition. Evidently there had been a large flight to the lamps the previous evening. Dr. Bethune happened to be in Montreal in the evening of the 23rd and in crossing the city from the Windsor to the Place Viger Railway Station, observed and wondered at the great quantities of white moths around nearly every lamp, capturing some to make sure what they were and was surprised to find E. subsignarius swarming at so late a date—a full month later than in 1908. Among my captures on 24th August, was one female, the only one seen attracted to light among several thousands observed of the male sex.

On September 4th, a couple of females were found on tree trunks in Mt. Royal Park, but they were worn and nearly dead—too weak to lay any eggs. These were the last that I noticed alive. Wings and dead moths still adorn many corners and basement window sills that are not swept out so carefully as they might be.

The simultaneous appearance of unusual numbers of any insect always makes one suspect migration from distant warmer parts, where they have been drawn up into the upper air and carried along by the wind, certain numbers dropping off here and there, as is the case with such moths as the Cotton Moth (*Alabama argillacea*), Erebus odoratus and many of the Southern Sphingidæ. I am inclined to think that in this case all the insects were bred in the neighborhood, but it is difficult to account for their excessive abundance on certain nights and absence on others over such a long period unless certain weather conditions are necessary for the final transformation from pupa to moth, or that only under favourable conditions are the male moths inclined to visit the lights. A study of the McGill College Observatory report of the local weather for the month throws no light on the subject, neither temperature, humidity, direction, or velocity of the wind, nor rainfall appearing to show any relation to the flights; but of course, a west wind might bring the moths from a tract of woods lying west of the city on one evening, while an east or a north wind might have the same effect on other evenings on those bred in the respective directions. It is quite certain the swarms of moths seen in St. James Street did not breed within a mile radius of Montreal General Postoffice. It is a curious coincidence that our other species of Ennomos, E. magnarius, usually so plentiful in September, has been scarcely seen at all either in 1908 or 1909.

NOTES ON FRUIT TREE SCOLYTIDS.

By J. M. Swaine, Macdonald College, Que.

There are three species of scolytid beetles occasionally injurious in parts of this country to orchard trees. Two of them, *Eccoptogaster rugulosus,* Ratz., and *Phlœotribus liminaris,* Harris, have recently caused considerable uneasiness in certain fruit districts of Ontario, and the third, *Xyleborus dispar,* Fabr., has been a well-known pest of Nova Scotian apple orchards for some years.

Apparently these insects are not serious pests in Quebec Province. *X. dispar* is found here commonly in *Betula lutea* and other forest trees, but I have not yet taken it in Quebec from orchard trees. The first two species are at least rare in the Montreal district.

Inquiries have come to this Department recently for an easy method of separating these three forms, and the following notes are to that end.

The Shot-hole Borer, *Xyleborus dispar,* cuts round, black tunnels deep into the wood; in small branches or stems one division of the tunnels partially girdles

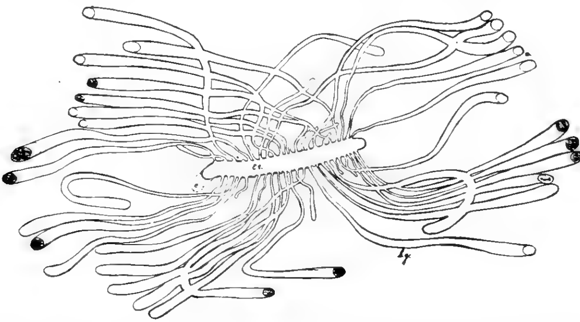

FIG. 1. Tunnels of E. rugulosus in peach: (*e*) entrance hole; (*e.t.*) egg tunnel cut by adult; (*l.g.*) larval gallery ending in *p.c.*—the pupal cell.

the wood. The eggs are laid free in the galleries early in June, and the larvæ feed upon the fungus which grows upon the tunnel walls, and gives the dark stain just referred to. The larvæ do not enlarge the tunnels, and emerge when matured, through the entrance hole cut by the mother insect. In the other two species each individual beetle, when ready to emerge, cuts a separate hole through the bark.

This species breeds in various forest trees and in fruit trees. Of the latter it apparently prefers the apple, and does harm chiefly to the young stock. The remedies aim to repel the tunnel-cutting females, which do the entire damage, or to destroy the food-fungus and the brood within the tunnels. Good results have been obtained in Nova Scotia from the use of a wash made of 3 gallons of water, 1 gallon of soft soap, and half a pint of crude carbolic acid. This wash is applied several times while the beetles are prevalent, the first application being made about the first of June. Badly infested trees should be burned, and those still of value may be treated with carbolic wash, and should receive good cultivation and plenty of fertilizer. Trees in good health are less liable to attack. Diseased

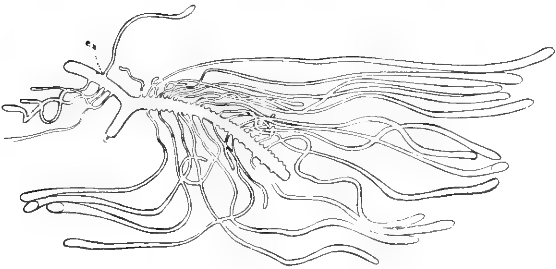

FIG. 2. Tunnels of P. liminaris: (*e.n.*) egg-niche.

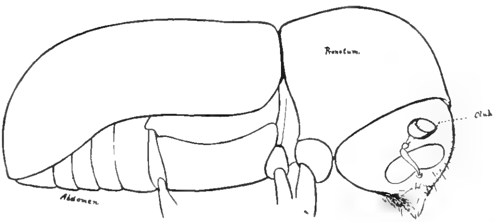

FIG. 3. Xyleborus dispar from the side, legs removed.

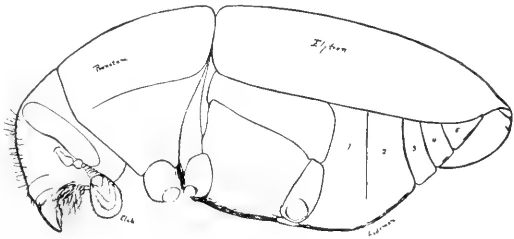

FIG. 4. Eccoptogaster rugulosus from the side, legs removed.

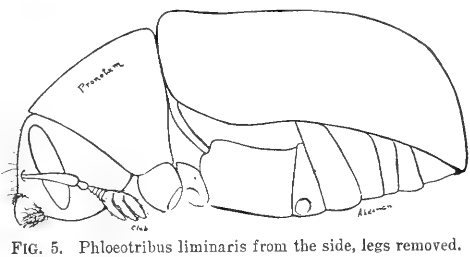

FIG. 5. Phloeotribus liminaris from the side, legs removed.

and dying branches should be removed and burned before the first of June. When fresh holes of this beetle are found in small trees, it is an easy matter to inject into the holes a little kerosene or other oil. The oil kills the insects which it wets, and destroys the food-fungus, with fatal results to the beetles and larvæ.

The adult female is black, cylindric, and about one-eighth of an inch in length. The pronotum is bent very strongly ventrad in front, so that the anterior opening is nearly horizontal. The head is globular and deeply sunk in the pronotum. The antennal club is sub-globular and truncate distally. The venter of the abdo-

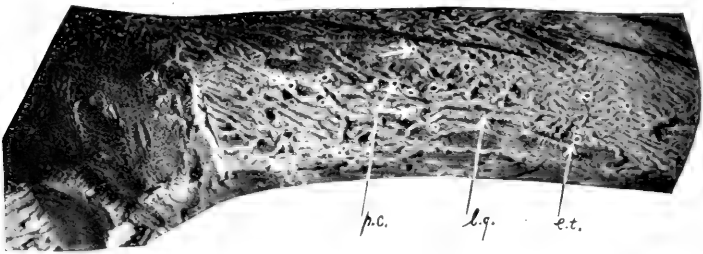

FIG. 6.

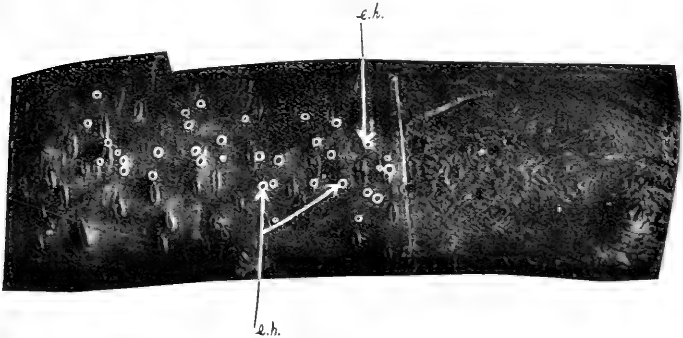

FIG. 7.

FIGS. 6 and 7. Work of E. rugulosus in apple; (*p.c.*) pupal cells sunk into the wood; (*e.h.*) exit holes of matured beetles. These holes lie usually immediately over the pupal cells. The smaller holes in figure 7 were cut by parasites.

men is evenly rounded. The truncate club and the strongly bent pronotum, as well as its larger size, distinguish it instantly from the other two. The males are much smaller than the females, wingless, and of a curious hump-backed shape.

The Peach-tree Bark-beetle, *Phloeotribus liminaris*, cuts all its tunnels between the bark and the wood. An egg-tunnel is cut by the adult and the eggs laid in niches along the sides. The larvæ bore away from the egg-tunnel, keeping between the bark and the wood, eventually following the grain of the wood, and pupate in the enlarged end of the larval galleries thus formed. Later they appear through holes cut in the bark above the pupal cells. The egg-tunnels of this species

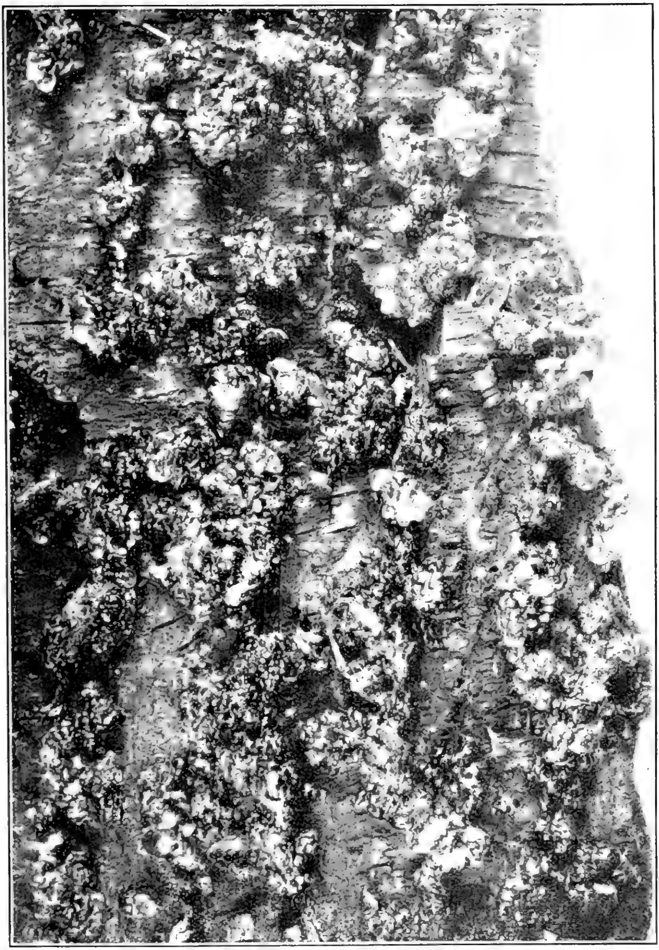

FIG. 8. Exuded Peach Sap from punctures of Fruit Bark-Beetle, (after Lowe, N.Y. Agr. Exp. Sta., Bull. 180).

are distinguished from those of *rugulosus* by a short side-branch which forms, with the short tunnel leading to the opening in the bark, a Y-shaped end to the main division, (See Fig. 2). The adults are brownish-black, about one-tenth of an inch in length. The pronotum is not bent strongly ventrad in front, so that the anterior opening is oblique. The head is large and visible from above. The antennal club is lamellate, divided into three separated, laterally produced segments. The venter of the abdomen is not bent strongly dorsad behind.

The damage inflicted by this beetle is mainly to the cherry and peach. Trees in apparent good health are attacked in the fall by the hibernating adults, and from the short tunnels then cut much sap exudes during the following season. Healthy trees are also attacked by the adults during the egg-laying season, but the vigorous flow of sap invariably drives them away. The brood can be reared only in weakened and dying trees. Successive attacks, however, will so weaken a tree that eventually the egg-tunnels can be cut and the brood reared, the result of which is the utter destruction of the inner bark. Slightly injured trees from which the beetles have been driven by the flow of sap should be well fertilized and protected from further injury, by a repellant wash. All dead and dying limbs and trees should be removed and burned before the emergence of the contained brood. Seriously injured trees are improved by a severe pruning. Mr. H. F. Wilson recommends the use of thick whitewash as a repellant, to be applied before the attack of the borers (Bull. 68, part IX., U.S. Bureau of Entomology). Good results seem to have been obtained in Ontario with lime-sulphur wash and with "Sanders' Wash" applied to the trunk and bases of the branches early in spring, about the first week in March, and again in July before the second attack.

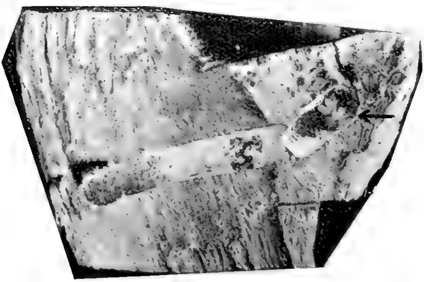

FIG. 9. Tunnels of Xyleborus in beech, arrow points to eggs.

FIG. 10. Tunnels of Xyleborus in beech, arrow points to female in characteristic position guarding the entrance.

The Fruit-tree Bark-beetle, *Eccoptogaster rugulosus*, Ratz., is of the size and general appearance of *P. liminaris;* but the venter of the abdomen is bent sharply dorsad beyond the first segment, and the antennal club is solid, flat and marked by strongly angulated sutures. The galleries of this species are entirely between the bark and the wood; the ends of the larval galleries, which form the pupal cells, are often sunk a few millimeters into the wood. This species agrees with *P. liminaris* in general habits. It breeds in dying limbs and trunks, but like

liminaris, injures living trees by driving short tunnels into the bark through which the sap flows copiously, later to harden and form the gummy masses which characterize the work of *P. liminaris* and *E. rugulosus* in healthy bark. This species attacks the apple, cherry and peach, and is often found working with *P. liminaris* in the same limb. The three washes mentioned above are also useful against this species

Clean culture is absolutely essential if these borers are to be controlled. Diseased and dying fruit trees furnish breeding grounds for these beetles and for numerous other insect pests, and should be burnt to prevent the spread of the insects beneath the bark and in the wood.

The following key will enable anyone to separate quite easily the three forms discussed. A hand-lens is needed for examining the antennæ, but the other characters are visible to the naked eye. The beetles are easily distinguished by their tunnels, as indicated by the diagrams.

A. Venter of the abdomen with the caudal portion bent abruptly dorsad. Antennal club flat and marked by angulated sutures. (Bark-borers) Eccoptogaster rugulosus (The Fruit-tree Bark-beetle).

AA. Venter of the abdomen normal, regularly curved.

B. Antennal club lamellate, of three separate, laterally produced segments. Head visible from above. (Bark-borers) Phloeotribus liminaris, Harris. (The Peach-tree Bark-beetle).

BB. Antennal club globular, truncate at the tip. Head deeply imbedded in the prothorax, the anterior margin of which is nearly horizontal, invisible from above. (Wood-borers, tunnels stained deep black). Xyleborus dispar, Fabr. (The Shot-hole Borer).

OBSERVATIONS ON ONTARIO INSECTS IN 1909.

BY C. J. S. BETHUNE, ONTARIO AGRICULTURAL COLLEGE, GUELPH.

As Mr. Gibson and Mr. Caesar have already presented reports upon the insects of the season, it only remains for me to refer to some that have especially come under my observation, or that have been a source of trouble to many correspondents.

The weather during spring and early summer seemed peculiarly favourable to the multiplication of Plant-lice (Aphids). They were to be found in more than usual abundance swarming upon a great variety of trees, shrubs, and plants, and causing a great deal of injury by checking the growth and impairing the vitality of everything they attacked. Cabbage and turnip plants were affected by them early in the season, but they ceased in most cases to be much trouble later on, in marked contrast to last year when they were a very serious plague till the frost came and destroyed them. In the vegetable garden peas, potatoes and lettuce were especially attacked and in the flower borders roses, asters, hollyhocks, etc., and even ferns; currant bushes had their leaves covered with wart-like swellings beneath which swarms of aphids were huddled: plum and cherry trees showed signs of the intruders by the crinkled and twisted leaves at the ends of the branches enclosing multitudes of black lice; on the leaves of apple trees green aphids were abundant, while twigs were soft and foliage tender, but later on they migrated to more succulent plants, probably to the wheat fields. Many elm trees looked sadly out of sorts from shrivelled and distorted leaves covered with disgusting woolly

lice, which were to be seen also wherever a scar was to be found on trunk or limb; great colonies of open feeding woolly aphids were also frequent on hawthorns. A clump of European lindens on the College lawn were so beset with lice that the leaves looked as if varnished owing to the incessant dripping of tiny drops of "honey dew," the sweet excretion from the hosts above; happily a couple of days of heavy rain washed the foliage clean and checked the increase of the aphis army. A handsome copper-beech on a friend's lawn in Hamilton was alarmingly attacked by another woolly form (the so-called wool is really wax), and its owner feared that permanent injury would result. In other places, maples, birches and various shade and ornamental trees were beset with these minute foes, while on firs and spruce were to be found the giants of the race, great black aphids, a hundred times bigger than the familiar green plant lice, belonging to the genus Lachnus. Widespread and varied indeed were the enemy, but their own foes speedily came to the rescue; Lady-bird beetles, yellow and orange and black, were to be seen in great numbers, and their larvae also were busily engaged in devouring the sweet morsels. The quaint, spiny chrysalids, sticking by their tails to the bark of trees, and occurring in masses, even fifty or more huddled together, were often sent in by observers fearing that they might be a new foe, and well pleased to learn that the formidable creatures were veritable friends. Syrphus fly larvæ and those of Lace-winged flies, aided by various other aphid eaters, combined to reduce the swarms, and these with a change of weather conditions, stayed or entirely removed the plague; during the latter part of the summer complaints almost ceased to be made. The standard remedies for these insects that live by sucking the juices of plants are kerosene emulsion, tobacco wash or strong soap-suds, preferably that made with whale or fish-oil soap.

Besides the scale insects referred to by others, there has been a widespread attack made upon trees in northern parts of the city of Toronto by the elm-tree scale (*Gossyparia spuria*). Last year it only came under my observation from its occurrence on the elms in a single garden, but it must also have been established unnoticed upon many others to have become so abundant this year. It would probably yield to treatment with the lime-sulphur wash applied at the usual time in early spring, but city dwellers with small gardens and few trees have no spraying outfit nor would they like to make use of a remedy so disagreeable to those who handle it. In their case much may be done by clearing off the scales with a scrubbing brush dipped from time to time in strong soap-suds. Where the elm-trees in parks, on boulevards and the sides of streets are attacked it is certainly the duty of those employed by the city to have the affected trees properly and thoroughly treated. Any neglect now may result in a widespread loss of these beautiful trees which grow so luxuriantly and are so attractive in and around Toronto.

The Cottony Maple Scale (*Pulvinaria innumerabilis*) which is essentially a town insect, attacking many other shade trees beside the maple, and when at its height spreading to plants of almost all kinds in parks and gardens, has been noticeable in several places this year. Like several other injurious insects it has its cycles of abundance and scarcity; increasing in numbers for some years and becoming a veritable plague, and then rapidly diminishing till it ceases to be noticed. This change is due, no doubt, to the attack of parasites combined with unfavorable climatic conditions. Repeated sprayings with kerosene emulsion when the lice are hatching out from the eggs contained in a waxy, cotton-like mass would keep the insect in check, and should be resorted to as soon as the scale is observed on the trees.

The oak trees in the neighborhood of the town of Galt have been stripped of their foliage both this year and last by the caterpillars of the Senatorial Moth (*Anisota senatoria*): the attack has been going on for four years and must result in serious injury to the trees if nature's checks do not soon come to the rescue. The caterpillars, when full-grown—which they were after the middle of September—are black with four ochre-yellow stripes along the back and two on each side. On each segment of the body there are six black spines or prickles, and behind the head two long slender horns projecting out on either side. The caterpillars feed together in great swarms, several hundred on a branch, and devour the foliage, beginning at the end of the twigs and moving downwards till they have completely stripped off all the leaves; then they move on to another limb. When at rest they huddle together in masses and if disturbed raise the fore part of the body and shake their heads in a threatening manner. They make no webs or cocoons, but descend into the ground to pupate and remain buried in the soil till the following June; the chrysalids then work their way to the surface and the moths emerge to lay their eggs and provide for a new generation. The eggs are laid in large clusters on the underside of oak leaves near the tips of the branches and the young caterpillars are hatched during the month of August. The moths are handsome creatures, ochre-yellow in colour with a shading of reddish-purple on the front and hind margins of the wings: an oblique narrow purple-brown band crosses the wings, and near the middle of each there is a conspicuous round white spot. The male moth is much smaller than the female and more tinged with purple, the expanded wings measuring about an inch and three-quarters; the female moth is fully two and a half inches in expanse, and often is entirely yellowish with no tinge of red or purple.

During the height of summer and throughout the autumn season numerous complaints have come in from many parts of the Province respecting White-grubs and Wireworms. The former have been more than usually abundant this year and have caused a great deal of loss by their attacks upon the roots of corn, grain of various kinds, strawberries, etc. The most remarkable and uncommon attack has been upon the tubers of potatoes, in which they have bored great holes and rendered them unfit for marketing or table use. Generally they feed upon the fibrous roots, but this year their numbers were so great that after consuming these the only food for them was the potato itself. As I have stated in the *Ontario Crop Bulletin* for November: "White grubs are the larvæ of what are familiarly known as May beetles or June bugs. They breed for the most part in old pastures and require three years to attain to maturity. Crops that are planted when an infested field has been broken up are usually attacked by these grubs. During the first year they feed to some extent upon the remains of the sod that has been turned under, but during the second year, there being nothing else, they attack the roots of whatever crop there may be. The best remedy for them is a short rotation of crops, so that there will be no time allowed for their attaining maturity. An infested field may be fairly cleared of them by permitting hogs to roam about; they will root the grubs up and eagerly devour them. Late plowing is desirable in order to break up their winter quarters and expose them to the weather and their various enemies. Working underground as they do, it is not practicable to apply any poisonous remedies. Dependence must be placed upon the methods referred to."

WIREWORMS, the larvæ of Click-beetles (Elateridæ), have a somewhat similar life-history to that of the White Grubs, except that the beetles pass the winter under the shelter of rubbish, tufts of grass, etc., and appear during the first warm

days of spring, whereas the May-beetles, the adult form of White Grubs, remain buried in the ground during the winter and come out in May or June. Complaints of injury to the roots of many plants by the attacks of Wireworms have been received from various quarters, in fact never a year goes by without much loss from their depredations. The methods referred to above for the control of White Grubs seem to be the only effective remedies for Wireworms also.

GRASSHOPPERS, which have already been referred to by Mr. Gibson, were extremely abundant and destructive this year, attacking oats and other cereals, and injuring vegetation of almost all kinds. In this case, also, old pasture fields, where the soil is dry and sandy, are the favorite breeding grounds, and hot, dry weather the most suitable for their growth and increase. The worst attacks were reported from the counties around the Georgian Bay. At the beginning of August Mr. Cecil Swale, Secretary of the North Bruce Farmers' Institute, Wiarton, wrote as follows respecting the Grasshopper plague:

"We have had these pests for four years in succession, each year worse than the preceding one. This year, I can go to farmers who off, say, 30 acres, have only got a load of fodder, counting hay, grain and everything. Many cut their oats three weeks ago to save what was left. I know fields to-day that are just standing oat stubs, the grain all on the ground. Nobody can quite credit the destruction they can do and are doing; you have to see for yourself. These pests breed in old pastures, roadsides and old meadows. Lots of these pastures cannot be plowed for rock, while being well adapted to this particular use. Then, again, you may have a first-class farm, and your neighbour has fifty acres of pasture alongside; the hoppers cross over and eat you out. You have no remedy. I have a pasture farm divided from the main farm by 100-acre swamp. I have not many hoppers, as all the home farm is pretty much under cultivation; but my neighbour on the other side of the pasture farm has been cleaned out by the hoppers off my pasture. My cattle have been starved off the fifty acres of pasture, and I have taken them up into my hardwood bush. My neighbour has not two loads of anything off a forty-acre clearance. Oats and barley and grass are their chief food. Peas they seldom touch.

"We have been thinking a few experiments might be tried to destroy the eggs of the grasshoppers in the fall, such as lime, salt, or a mixture of both, used as a top dressing on pastures. Possibly a spraying of formalin and water might destroy those now living. The eggs are laid in September by the grasshoppers depositing them in small bunches of twenty or thirty eggs stuck together just below the surface. Skunks dig up great quantities of them in October. I opened a number of grasshoppers yesterday that seemed very large. Nine out of ten were filled with thread-worms, white, six inches long, which would seem to point out a possibility of the brutes dying soon. They are also infested with a bright red parasite. There are thousands of dead ones all over the meadows, but there would be no room for the living if some of them did not die. Naturally dry weather favours their increase, and as the last three summers have been dry we have had an extra hard crack from them. Matters are so serious with the farmers of the townships of Albemarle, Amabel and Keppel (in Grey) that I know many farmers will leave their farms, and many more would go if they could. We all thought last year would be the last of them, but the contrary was the case. Nobody cares to venture an opinion about next year now.

"As the grasshopper dies in the fall, the remedy appears to lie in getting after the eggs. The Criddle mixture, as recommended by one of the bulletins, does not work here; they won't eat it. They don't seem to eat anything which has been dosed with Paris green. I am sure the careful consideration of this matter will be most acceptable to all of us who are unfortunate enough to live in this district."

The Criddle mixture has been so often tried and found effective on a large scale in Manitoba and in many places in Ontario, that we are surprised to learn of its failure in this case. Mr. Criddle himself states that many applications of the mixture have been made this year and that it has proved entirely effective. It may be that some error was made in its preparation or mode of distribution.

The white worms found inside the bodies of some Grasshoppers are commonly called "Hair-snakes" (Gordius) and are well-known parasites of both crickets and grasshoppers. They evidently destroy large numbers, but amongst such hosts as above described, it would require an enormous army of the worms to

appreciably reduce the swarms. Scarlet mites, the red parasites referred to, are also commonly to be found clinging to their hosts and helping to destroy them. The destruction of the egg masses by breaking up the soil in which they are laid is by far the best method of getting permanently rid of the pests.

INJURIOUS INSECTS OF QUEBEC, 1909.

By William Lochhead, Macdonald College, Que.

The season of 1909 was in many respects abnormal. Spring was tardy throughout the Province and the crops were sown later than usual, on account of the cold rains. Summer weather conditions also differed in different parts. On the Island of Montreal there were timely showers throughout the summer, so that the crops at no time suffered from drought. Over a large part of the Eastern Townships, however, little or no rain fell during June, July and August, and the late sown crops suffered from lack of water. In the latter part of August rains fell which interfered with and delayed the harvesting of the crops. The autumn has been unusually free from frost. Very few of the outside flowers were nipped by the frost until the 20th of October.

Orchard Pests.

Orchards in Quebec are not well looked after as a rule. The majority of them are not pruned regularly, and as a result, the trees have too many twigs and branches, and the excessive foliage does not allow of the proper access of sunlight. Such conditions are congenial for the development of Apple Scab and the Brown Rot of Plums. Spraying is a practice indulged in by but few, and these are the up-to-date fruit growers, usually active members of the Quebec Pomological Society, who make money out of their Fameuse and St. Lawrence apples.

Cultivation of the orchard is sadly neglected, consequently there is ample opportunity for the safe hibernation of the more injurious insects, such as the curculio and the codling moth.

The Codling Moth.—This is undoubtedly the worst insect pest of the apple. It causes an enormous loss in orchards over the entire Province, and one sees no hope of abatement until the people learn to take better care of their orchards; by pruning, spraying, cultivation and destruction of the rubbish. Much good could be done if practical demonstrations were carried on by the Government to show how and when to spray and the value of spraying. I believe the time is fast approaching when the people will be ready to profit greatly by such demonstrations, for Quebec is well adapted climatically for the growing of apples of superior quality. Its Fameuse apple is known most favourably in all the great markets.

In spite of all that has been written, the life-history of the codling moth is not well enough known to the average farmer and fruit-grower. We entomologists must keep hammering away year after year until the fruit-grower can fight this enemy successfully by taking advantage of the weak spots in its life-history.

In Southern Quebec, including the border counties, there is in all probability a partial second brood; and it is the worms of this second brood that produce the wormy apples late in the season. The fruit may be entered at any point, and often an ugly scar is made on the surface, by the larvæ. A thorough

spraying with lead arsenate just as the petals have fallen, and another application ten days or two weeks later should kill the great majority of the first brood. To intercept the larvæ that escape these two treatments it would be advisable to apply a burlap bandage about the trunk in late June. The worms in escaping from the fruit find the burlap a convenient place to hide and to spin cocoons. To prevent the small portions that pass through a partial brood from doing injury the burlaps should be removed every ten days, and replaced after all larvæ and cocoons have been destroyed.

THE BUD MOTH. This enemy of the apple was quite prevalent about Abbotsford, and perhaps in other localities.

THE OYSTER-SHELL SCALE OR BARK LOUSE. As one would naturally expect, Oyster-shell Scale is quite prevalent in the apple orchards of Quebec. This insect may be looked upon as the enemy of half-tended and neglected orchards. It is not a difficult insect to control, yet it does annually a great amount of damage. Many owners of orchards when asked if the Oyster-shell Scale is present in their orchard will state that they are not acquainted with it. They have not yet come to recognize it as an insect and as a serious enemy. The insect passes the winter in the egg state under the gray-brown, oyster-shaped scales on the bark of the twigs and branches. The eggs hatch early in June; the yellowish lice crawl about for a few days and then settle and secrete a scale over themselves. There is but one brood each season.

An application of whitewash to the trunk and large branches during the winter will remove the scales and leave the branches clean in the spring.

THE APPLE APHIS. This insect was reported as abundant about Abbotsford, and in the Montmagny and Kamouraska districts below Quebec. It was observed on some of the trees in the young orchard at Macdonald College.

THE AMERICAN TENT CATERPILLAR. This insect, which was so abundant and injurious a few years ago, was again in evidence in many localities. It would be advisable for farmers to be on the look-out for the ring-like clusters of egg masses which encircle the twigs of apple and other trees during the fall and winter months, and to destroy them.

THE PLUM CURCULIO. Curculios were very prevalent in Quebec orchards in 1909. In some orchards a large percentage of the apples were deformed by the numerous curculio punctures, and were rendered practically useless. This widespread injury to the apple crop demands attention; this note is written with this purpose in view, and at the same time to outline concisely our knowledge of the habits of this most destructive insect enemy of plums and apples, and the best remedies that are being used elsewhere to control it.

At the outset it may be said that this pest is no new enemy. For many years it has given more or less trouble to orchardists, making itself more conspicuous by its injuries some years than others.

There are probably two species of curculios that are responsible for the injury in our orchards. The *Plum Curculio* (Conotrachelus nenuphar, Herbst) and the *Apple Curculio* (Anthonomus quadrigibbus, Say). It is believed, however, that the former does the greater amount of injury, although no careful observations have been made in Quebec to determine their relative abundance.

The Plum Curculio is a native of America, and fed originally upon the wild plum, wild crab-apple, and the hawthorn. With the advent of the cultivated apple it took readily to the new fruit, which it continues to infest.

Life History. The adult curculio beetles winter over in rubbish on the ground, under bark and elsewhere, and emerge from their hiding places about the time the plums and apples are in blossom. The eggs are deposited within punctures partially surrounded by a crescent-shaped slit in the newly-formed apples and plums. The eggs hatch in less than a week and the larvæ proceed to make channels in the fruit. Infested fruit soon falls, and in about three weeks the mature larvæ emerge and enter the ground. There they pupate, and in about four weeks emerge as beetles. These soon fly to the fruit and continue feeding upon it, until the fruit is picked from the trees, marking it with the characteristic cylindrical punctures. As winter advances they hide themselves under rubbish and bark to hibernate until spring.

The adults that emerge in summer deposit no eggs, *all* the eggs being laid by the over-wintering beetles. The injury to apples is done mostly by the beetles that mature in summer, as they make deep punctures when they feed upon the fruit.

It is rather a strange thing that curculio larvæ develop only in small apples, and will not reach their development unless the apple has fallen.

A single mother curculio may deposit between 200 and 300 eggs, extending over a period of three months, hence is capable of doing a great deal of injury. This great egg-laying and puncturing power of the beetles explain the greatly distorted condition of many of the apples observed this year at Brome, Abbotsford, and elsewhere. In the great majority of apples examined there were as many feeding-punctures as egg-punctures. Not in every case did the eggs develop when deposited within the crescent-shaped mark, for we found many apples that showed the crescent slit but had no trace of larvæ.

Treatment. Observations made in Illinois and elsewhere show that uncultivated orchards suffer most from curculios, and our Quebec orchard conditions would favor drawing the same conclusion. And such is what we might naturally expect, for the conditions of the uncultivated orchard, with the excessive amount of grass and weeds and rubbish, and the absence of pruning, furnish ideal conditions for the development of the curculio. Besides, the proximity of neglected orchards is a menace to clean orchards.

There are four ways of treating the curculio:

1. *The destruction of fallen fruit,* so as to kill the larvæ before they make their escape into the ground. The *early small* apples should be specially looked after in June and July, for these contain a large percentage of the larvæ. The later and larger fallen fruit do not, as a rule, contain many larvæ.

The presence of hogs in an orchard is strongly recommended, if no other means can be found to clean up and destroy the fallen fruit.

2. *Suitable cultivation,* so as to destroy many of the larvæ and pupæ in the soil. It has been found that the larvæ and pupæ are extremely sensitive to physical disturbances of any kind, as well as to light and air. Cultivation permits their exposure, for a short time at least, to sunlight and to the attacks of their enemies, birds, ants, and predaceous insects. As a rule, orchardists prefer to cultivate up to the middle of July, but where curculios are doing much harm this cultivation should be continued for a month longer, in order to do effective work to the larvæ and pupæ in the soil.

3. *Spraying with Paris Green or Arsenate of Lead,* to destroy the adult beetles. This treatment has not given good results, and it is doubtful if the practice warrants the trouble and expense.

4. *Jarring the trees,* to collect the beetles that fall on sheets under the trees. This method also is slow, and it is doubtful if the practice warrants the trouble and expense, save with young apple trees and with plums and cherries.

Farm Crop Insects.

Grasshoppers and Blister Beetles. Grasshoppers and Blister Beetles appeared in alarming numbers in August and September in many districts of the Eastern Townships. The former swarmed in oat fields and the latter in clover and mangel fields, and considerable loss was incurred.

The increasing amount of permanent pasture land in Quebec furnishes undisturbed breeding grounds for grasshoppers. The eggs are laid in masses below the surface of the sod in late summer and early fall, and hatch the following spring. As a rule, the young grasshoppers are not numerous, and confine their attention to the pasture lands, but should conditions at any time favor their multiplication they spread to the adjacent grain fields where food is more plentiful. It has often been observed that grasshoppers are seldom abundant two years in succession. The reason for this is that their very great abundance allows their numerous enemies to multiply very rapidly. Among those enemies are:

(1) *Parasitic mites,* bright red creatures often seen at the bases of the wings, which not only suck the blood of their hosts, but also later destroy the egg masses.

(2) *Hair-worms,* which live within the bodies of the grasshoppers and destroy large numbers.

(3) *Tachina flies,* whose maggots live within the bodies of the grasshoppers.

(4) The young of *Blister beetles,* which devour the egg-masses in the ground.

(5) *Fungous diseases* that often spread with great rapidity.

It is quite probable, therefore, that grasshoppers will not be much in evidence next year, and that there will be a rest from their ravages for a few years.

It is possible to guard against such losses as have occurred this year, by watching the pasture lands, and if grasshoppers are very numerous, it would be advisable to make applications of poisoned bait in the pastures, if it is safe to do so, along the edges of adjacent grain fields. This poisoned bait may be made by mixing 1 pound of Paris green in 50 pounds of bran, made into a mash with water and sweetened with cheap molasses. This is distributed in handfuls to infested areas. In Manitoba a bait known as the Criddle Mixture is used with great success. It is made by mixing 1 part Paris green, 2 parts salt, and 100 parts of horse manure. Enough water is added to make a soft, not sloppy, mash. The mash is scattered over the field where the grasshoppers are thickest.

Black Blister Beetles, called by the farmers "Blue Beetles," were quite destructive this year on clover, mangels and beets.

They are often found feeding on other plants, such as the golden-rod, aster, pigweed, corn, beans and potatoes, and in the days before the arrival of the Colorado Beetle, this and allied species were the main insect enemies of the potato crop.

The adults are soft-bodied, with long, slender legs. They occur from August to October. The females deposit their eggs in the ground, and from these hatch out active, long-legged larvæ called "triungulius," that feed on the eggs of the grasshopper.

It will be observed, therefore, that while the adult Blister Beetles are injurious to some of our crops the young of these are decidedly beneficial. It is a

difficult matter to decide sometimes whether it is advantageous to poison the adults, for if this is done there will be no larvæ to devour grasshopper eggs.

Should the adults become sufficiently injurious to warrant action, applications of Paris Green or arsenate of lead will readily kill them. On account of the abundance of grasshoppers this year, we may expect a large number of blister beetles next year.

Wireworms and White Grubs.

Among the list of injurious insects of farm crops, none perhaps surpass Wireworms and White Grubs, in the amount of damage inflicted. They work away unseen underneath the soil, and on this account are unknown to the casual observer. They are peculiarly the enemies of the careless farmer, and their presence indicates that something has not been done properly and at the right time. It may be that the pastures and meadows have been allowed to remain down too long; that a suitable rotation of crops is not practised; or that there is little or no fall plowing done.

Wireworms are the grubs of click-beetles or "skipjacks," and White Grubs are the grubs of June beetles, with which most persons are quite familiar.

Wireworms. The adult beetles appear frequently in the spring and the females deposit their eggs close to the roots of grasses or weeds. The Wireworms, however, do not confine their attacks to the roots of grasses and cereals, but often devour the roots of other crops and even the seeds of corn, wheat and other grains. In fact there is no plant that is immune from their attacks, so far as we know, although many farmers in England claim that buckwheat, mustard and rape escape. The Wireworms, of which there are many species, are hard, smooth, shining, yellowish-brown, wire-like grubs, and possess three pairs of short legs, hence they are readily identified.

Many attempts have been made to devise some reliable method of destroying them. Some years ago Professors Comstock and Slingerland, of the Cornell Agricultural Experiment Station, and Professor Forbes, of the Illinois Station, conducted a very complete series of experiments extending over a number of years, and found that insecticides were practically of no value. They ascertained, however, that certain cultural operations were valuable in destroying large numbers of the transforming pupæ and adults before they emerged from the cells in the ground. Wireworms spend from three to five years in the ground and transform to pupæ and adults in the late summer and autumn. But the adults remain in the pupal cells, and do not emerge until the following spring. It was determined that these pupæ and adults wintering in the pupal cells were very sensitive to distributions such as late plowing produces. Plowing infested or suspected sod-land twice—once in August, with a good harrowing a week later, and again in late September or October—will break up many of the pupal cells and expose the beetles during the winter to conditions which they cannot survive.

This cultural process will not interfere with the Wireworms or those in the grub stage. When a sod-land is broken there will naturally be Wireworms in different stages of development, some in the first year larval stage, some in the second year, and some in the third year, and others ready to pupate. Only those ready to pupate will in all likelihood be killed by the fall plowing. In the following season, however, the young grubs are growing rapidly; and if the dying roots of the sod furnish sufficient plant food, they will not do much feeding on the roots of the new crop, but will be more injurious the year following. Now certain crops, such as clover, barley, wheat and rye, are not so liable to attack as are corn,

potatoes, mangels, oats; hence, they are better adapted to follow sod. Clover can be sown with barley and rye and plowed down after a cutting has been taken. This may be followed by corn or roots. Such a rotation will gradually exterminate the Wireworms, and furnish crops that give a good yield.

Short crop rotations will never allow Wireworms or White Grubs to make headway and develop, for there is too much disturbance of the soil and change of food plant. The best method of breeding these insects is to allow pastures to go unbroken for a series of years, for then conditions are particularly favourable for their development.

Sometimes it is possible to force the crops through an attack of Wireworms, by the application of mineral fertilizers to stimulate the plants.

White Grubs. White Grubs, as already stated, are the larvæ of June beetles, and are large, soft, whitish or yellowish grubs, with brown heads and three pairs of legs. The bodies are larger towards the hind end, and usually appear half-coiled. Like the Wireworms they require about three years to complete their development from egg to beetle. The adults appear in May and June, often in large numbers, to feed on the foliage of certain trees, such as plums, willows, etc., and to deposit eggs below the surface of the ground, usually on the roots of grasses and many other kinds of plants. The grubs on hatching begin to feed on the roots, and often do considerable damage. Dr. Forbes, of Illinois, who has given a great deal of study to White Grubs, is of the opinion that the grubs do not change to pupæ until June or July of the third season; that they change to beetles a few weeks later, but that these do not emerge from the pupal cells until the following spring. He is also able to identify several distinct species of Lachnosterna, of which *fusca* is the most common.

As with Wireworms, remedial measures are difficult. Special rotations are advisable. Fletcher says: "A short rotation in which clover follows grass or is grown at short intervals, will prevent the increase of these insects. In this special rotation the small grains should follow clover before corn or potatoes." When a field becomes infested with White Grubs a portion of the clover field, for example, might be broken and planted to corn instead of planting corn after timothy or grass. To make up for the deficiency of clover, that portion of the sod field which would have been devoted to corn could be sown with oats, vetches, etc., for green feed and hay. It is perfectly safe to put mangels, turnips and rape after old sod, although one will have to be on the guard against cutworms nipping off the young plants.

Cutworms and Flea-beetles. Considerable damage was done in June by cutworms on turnips, carrots and mangels, before they were detected, but the application of poisoned bait prevented further action.

In the Experimental Plots at Macdonald College the Wheat Aphis and the Wheat-Stem Maggot again made their appearance, but not in such numbers as in 1908. Flea-beetles were observed on some plots but they did no serious damage.

Root Maggots. These were numerous on many kinds of plants, viz., radish, cow-peas, soy beans, cabbage, onions and turnips, and caused considerable loss.

Cucumber Beetles. These appeared about June 10th at Macdonald College, and did more harm to squash than to cucumber, pumpkin or melon. Mr. Swaine reports that Bordeaux Mixture seemed effective, but they return to the new leaves and flowers.

Leaf Miners. Beets and spinach at Macdonald College were injured by leaf-miners. They attacked small leaves, and had practically disappeared by July 4th.

Currant Borer. (*Sesia tipuliformis, L.*). Mr. Swaine reported considerable injury to stems of both black and red currants. In some cases the stems were dying, and the leaves dried and discoloured. The larva bores in the pith sometimes for over six inches; it remains in the wood all winter, and in the following summer, in June, the bluish-black fly-like moth emerges to lay her eggs at the buds on the young wood.

Gooseberry Span-worm. (*Cymatophora ribearia*, Fitch). The moths were observed July 24th, not only on the gooseberries, but also on the currants, in the Macdonald College plantation. They fly readily in day-time when disturbed, and are attracted to light at night.

The larvæ or caterpillars are to be found in June; they are white, dotted with black, with yellow stripes about an inch in length when full grown. There is but one brood in a year; the eggs are deposited in July on the twigs, where they remain all winter.

This insect is capable of doing considerable injury to the leaves of gooseberry and currant. Arsenate of lead will control it.

Currant Aphis. (*Myzus ribis, L.*). The reddish blisters on the leaves of currants—the work of the currant aphis—were much in evidence in many Quebec plantations this past season. Inasmuch as the deformations interfered with the proper functioning of the leaves, considerable injury was undoubtedly done. Careful examination for the presence of aphids on the young leaves should be made, for it is much easier to kill the insects when they are few in number and before the leaves have become deformed, by applications of whale oil soap or kerosene emulsion solutions.

The Carrot Rust Fly. (*Psila rosæ*). This insect did considerable damage in some of the truck gardens about Montreal. Mr. Swaine received on July 14th, from McKinnon & Son, a package of small carrots which were riddled by the maggots of this insect.

The Fall Web-worm. The unsightly webs of the Fall Web-worm were very abundant both on forest, shade and fruit trees throughout the Province. Mr. J. M. Fisk, of Abbotsford, reports it as prevalent in his district, and Rev. Brother Liguori states that it was abundant at La Trappe.

ANISOTA VIRGINIENSIS, DRURY.

By Thomas W. Fyles, D.C.L.

Anisota virginiensis is one of the insects injurious to the oak. In some years its ravages are very apparent. I have succeeded this year (1909) in bringing its larvæ through their successive stages.

I had tried, on several previous occasions, to raise the species, but had failed. I attribute the failures to the fact that oak-spray, severed from the tree, dries very rapidly; and, as there were no oaks growing near my former residence, I could not keep the larvæ supplied with sufficiently tender food.

In my present place of abode I am better situated, as the White Oak, *Quercus alba*, is common in the neighbourhood. I have taken the precaution too, of placing every fresh supply of food for the Anisota under the water-tap, and drenching it thoroughly, before placing it in my insect breeding-cage. This plan has proved very successful.

A. virginiensis is widely distributed in the Province of Quebec. Mr. A. R. M. Boulton, President of the Quebec Branch of the Entomological Society has two specimens (♂ & ♀) that were taken, I believe, at Cape Tourment in Montmorency County. I have frequently met with larvæ of the kind on the Island of Orleans, and, on the 16th of last June, I found a beautiful male moth of the species, lying under an arc-light, near some oak trees, on Front Street, Hull. On the 29th of the same month, Miss M. G. Johnson, a member of the Entomological Society, sent me from Miranda, Missisquoi County, some oak-leaves laden with the eggs of the species, and also one of the moths that she had found laying the eggs, and a male of the same species.

The eggs lay close together, in broad patches which in several instances covered the under-side of the leaf—none were laid on the upper side. They were of a roseate light brown tint, but here and there was a pale green egg seemingly unfertilized.

The egg of *A. virginiensis* is globular in shape; but as the larva within advances in growth it becomes depressed, and loses its roseate tinge, till at length the little black-headed larva, snugly coiled, is plainly visible within the shell. The egg is one-twenty-fourth of an inch in diameter.

Doubtless the eggs sent me were deposited by several females of the same kind, and at slightly different intervals, for they hatched irregularly. The first of the young larvæ to appear left the shell the day after the eggs reached me—*i.e.,* on June 30th, and the others appeared at intervals for the next fortnight—consequently, some of them had reached the third stage while others were only in the first. In these notes I have followed the larvæ first hatched.

The newly-hatched larva was one-eighth of an inch in length. Its head was large in proportion to its body, and jet black. The mouth-organs were yellow. The body was yellow, and set with short spines. The legs were pale yellow and semi-translucent.

The larvæ are gregarious. They eat away the substance of the leaf, leaving only the mid-rib and some of the larger veins. When they have finished with one leaf, they proceed to another on the same twig, and, having stript it, they advance to a third, and so on—moving from leaf to leaf and from twig to twig.

The first moult took place on the 6th of July. After it the larva was a quarter of an inch long. Its head and fore-legs were black; its body was pale yellow; it had on the third segment two seven-jointed black horns. Along the middle of each of the following segments on the upper side was a row of small warts—each wart bearing a short bristle. A few white hairs extended from the black head. Towards the end of this stage in the larva's existence the segments of the body became more distinct and assumed a bluish green tint, with slightly darker longitudinal stripes.

The larva moulted again on the 14th of July. The old skin broke at the head to allow the larva to escape from it. When it made its fresh appearance the head, horns, anal segment and fore-legs of the larva were green, but they soon changed to black.

The body colour in this stage was sage green, with yellow sub-dorsal, side, and spiracular lines. There were several black, pointed tubercles along the middle of each segment, on the upper side. The spiracles were black. The black, glossy horns on the third segment extended beyond the head. There was a black granulated plate on the second segment, and before the horns on the third.

The larvæ again moulted on the 23rd of July. Their vacated skins were left in rows adhering to the mid-ribs of the leaves which they had skeletonized. Their body colour was now black. As in the previous moult the head, etc., were green at first, but soon changed to black. The whole body was firm and glossy. There was a double line of yellow along the back; and the sub-dorsal, side, and spiracular lines were yellow. There was a row of spike-like protuberances around the segments on the upper side—on the anal segment there was a cluster of such protuberances. In this stage the larvæ attained a length of one and one-sixth inches.

They moulted again on August the 4th. Their length after the moult was one inch and five-twelfths of an inch.

The larvæ reached their full growth by the second week in August. They were then two and a quarter inches long, cylindrical, glossy black with very conspicuous yellow lines. The spiracles were black. There was an oblong yellow spot over each of the prop-legs and a similar spot on either side of following segments. The thorny protuberances on the segments were well developed, and at the end of the body there was a cluster of such protuberances.

The larvæ began to enter the soil on the 10th of August; and before the end of it, all in my keeping had buried themselves; but, so late as the 13th of September, I found in the woods a solitary straggler of the species.

The pupa is finely sculptured. Its abdominal segments are boldly outlined; and from the last of them projects a stout spine forked at the end. This probably serves as a lever, to enable the chrysalis to work its way to the surface of the earth, when the imago within it is nearing perfection.

In rearing the larvæ of *A. virginiensis* two particulars drew my attention specially. One was that, in the later stages of their growth, some of the caterpillars were *much smaller* than the others. In the final stage the smaller ones were only two-thirds the size of the larger. I should say that these were the undeveloped males, for the male moths of the species *are much smaller* than the females.

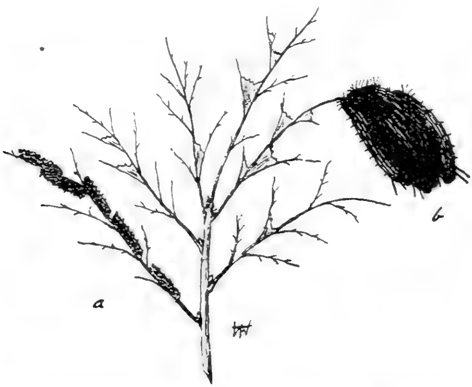

FIG. 11. Oak leaves skeletonized by *Anisota virginiensis*: (*a*) vacated skins of larvæ; (*b*) Larvæ bunched together for mutual protection.

The other particular was, that the larvæ in their later stages, had the habit of grouping themselves into clusters at the ends of the mid-ribs of the leaves which they had skeletonized. In these positions they somewhat resembled the small webs, that, in August, are so frequently to be seen on forest trees. (Fig. 11)

ADAPTATIONS IN THE STRUCTURE OF INSECTS.

By Rev. Thomas W. Fyles, D.C.L.

On a certain occasion last summer, a friend of mine was standing on a bridge, which spanned a shallow creek that had a muddy bottom. His attention was taken by the proceedings of a large dragon-fly that was hovering close to the surface of the sluggish stream, at the shallowest part of it. The insect repeatedly thrust its abdomen down through the water, and into the mud. My friend could see the slight disturbance in the mud as the point of the insect's abdomen entered it and was again withdrawn. The fly was depositing its eggs. Here then was revealed one reason why the dragon-fly has so lengthy a tail.

It is interesting to see one of the "Demoiselles"—Agrionidae—alight on a floating leaf of a Pond Lily, and bend its long abdomen round the edge of the leaf to affix its eggs on the under side—the side in contact with the water.

The perfect fitness of every part of an insect for the functions it has to serve will always be admired by the inquiring and thoughtful observer.

In our early lessons in Entomology certain facts were impressed upon our mind, viz.—that an insect is a creature that is cut into or notched; that the notches mark out the head, the thorax, and the abdomen; that the insect passes through four stages of existence—the *Egg*, the *Larval*, the *Pupal* and the *Imago* stages.

In this short article I purpose to offer a few desultory remarks on the several features of the insect form, and on the several stages of insect life—endeavouring to show the admirable fitness of the insect to meet, at all times, the exigencies and requirements of its existence.

The Head. In the head of an insect the striking and important features are the eyes, the mouth organs, and the antennæ.

In the larger dragon-flies (Fig. 12), such as those in the genera Æshna and Anax—insects of extremely rapid flight—the eyes occupy the main portion of the head space. The huge compound eyes of *Anax junius* are contiguous; yet they allow room for three ocelli. Nothing seems to escape the glance of these splendid insects; and in the bright sunshine, when they are most active, the ease with which they evade the sweep of the net of the entomologist, though it may be provoking to the sportsman, must nevertheless awaken his admiration.

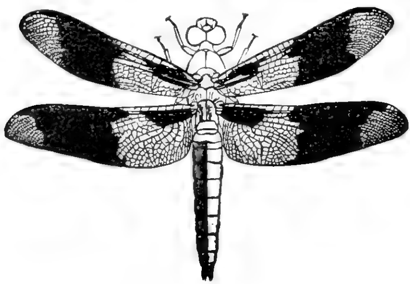

Fig. 12. Dragon Fly.

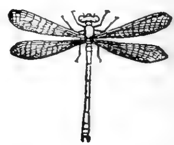

Fig. 13. Damsel Fly.

In the Agrionidoe or Damsel-flies (Fig. 13),—insects of less rapid flight—which can take a more leisurely view of things—the head, as Wood remarks,*

* "Insects at Home," page 275.

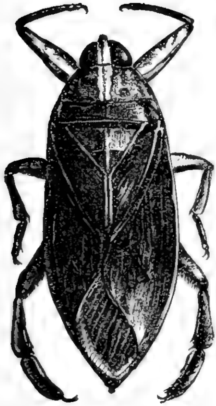

FIG. 14. Giant Water Bug.

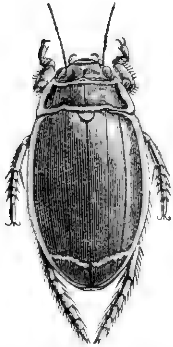

FIG. 15. Diving Beetle.

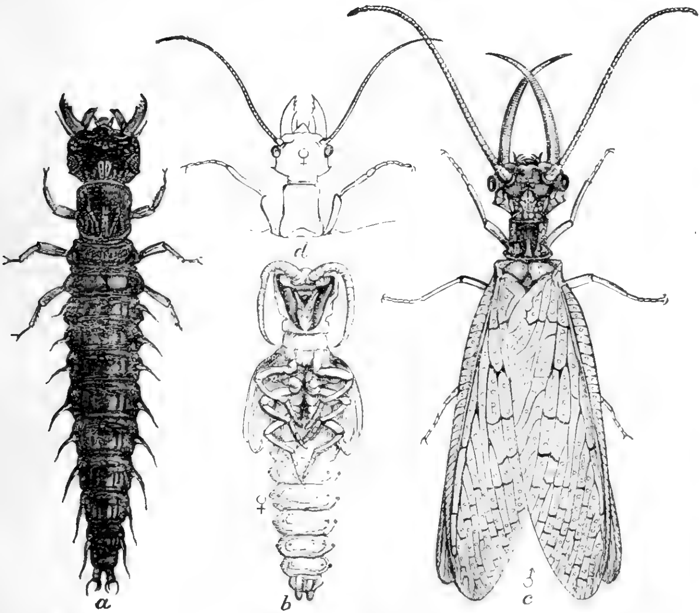

FIG. 16. Giant Water Fly (Corydalis cornutus), (*a*) larva ; (*b*) pupa ; (*c*) male fly ; (*d*) head of female fly.

reminds one of that of the Hammer-headed Shark; and the eyes project from the sides of it. These dragon-flies, like others of the Odonata, can turn their heads half round on the neck, and so look over their shoulders.

Another insect with large and protruding eyes is the Giant Water Bug, *Belostoma Americana* (Fig. 14). So far do the eyes of this insect protrude one might almost expect that, in the wild dashes of the insect through the upper air, and into and under the water, they would be swept from their position. But a remarkable provision prevents the danger; from the centre of the saucer-like eye-socket arises a stout support, flattened out a little at the top—somewhat spool-shaped—and around this the eyelets of the compound eye are compressed. (Fig. 15).

In the Diving Beetle, *Dytiscus Harrisii* (Fig. 15), an insect of very similar habits to *B. Americana*, the eye is so placed in the side of the head that the creature can see both above and below; and the organ is protected by a curved extension of the pro-thoracic shield.

The like protection is afforded to the eye in water-beetles of other genera—Hydrocharis, Colymbetes, Acilius, etc., while in Dineutes the eye appears to pass through the substance of the head, so that the insect seems to have four eyes—two above and two below.

That widely different and very minute insect the White Fly of the greenhouse appears to have eyes similarly arranged to those of Dineutes. In the fly the eyes appear as two black dots above, and two black dots beneath the head.

The mouth organs of insects vary considerably to suit their different habits. There is a striking difference in the mandibles of the male and female imagos of the Giant Water Fly, *Corydalis cornutus* (Fig. 16). This is the more remarkable because in the larval and pupal stages of the sexes the organs apparently are alike. Some years ago I traced the life-history of this species through its metamorphoses. I saw the nymph draw itself about in its cyst, by means of its formidable mandibles; and I expected that, when the change to the imago came, the insect would prove to be a female; but lo, when it came, and the imago burst from the nymphal case, the mandibles were extended (I presume by inflation) into the preposterous organs we see in the male. Why is this difference between the male and the female mandibles? It is that the male may be able to give a loving embrace to the well-defended neck of its mate.

How strangely the lips and jaws of the dragon-fly work, in masticating its food, as if they were at cross purposes, the lips perpendicularly, the jaws horizontally—they are two pairs of very effective cutting knives.

Belostoma Americana lives by sucking the life-fluids of its prey, and is furnished with a stout beak-like proboscis, about a quarter of an inch long. This proboscis consists of an outer pointed case, having a longitudinal slit in front, and of an awl-shaped sucking instrument enclosed in a divided sheath barbed at the extremity. It is a formidable weapon.

The bug clings, by means of its powerful front legs, which are terminated with sharp claws, to the fish or other creature that it assails, and thrusts its proboscis into its victim.

The Reduviidæ, or "Assassin Bugs," are furnished with beaks of like construction. The stories told us of the "Kissing Bug" have led us to understand how dangerous, under some circumstances, these weapons may become.

The proboscis of the House Fly is terminated by two ridged valves with which the insect scrapes up its food. Those who have volumes bound in sheep-skin, and exposed in open cases, will soon find, from the roughness and loss of gloss in the binding, that the flies have been at work upon the dressing of the leather.

How different, and how wonderful, are the trunks of the nectar-sipping moths and butterflies! They lie curled up so compactly within the sheltering palpi, and can be extended so far when occasion requires. The length of the proboscis in these cases enables the insect to take its food, as it hovers over the blossoms, without injury to its wings.

Of the purposes served by the antennæ of insects we know but little; but it is obvious that they are fitted to the requirements of the species they adorn; the bee, which enters blossoms in search of pollen and nectar would find antennæ like those of *Paniscus geminatus* unmanageable and entangling; and *Geotrupes Blackburnii,* would have difficulty in delving in the earth, if it were burdened with antennæ like those of *Monohammus titillator.*

THE THORAX. To the thorax of insects are attached the legs and wings.

Passing amongst the Golden Rod, this Fall, I came across three species of insects that secure their prey by means of their fore-legs, viz.—*Mantispa brunnea* (Fig. 17), *Acholla multispinosa,* and *Phymata erosa.*

Like the Praying Mantis of which Hood speaks, in his "Ode to Rae Wilson, Esq.," as—

> "An insect, of what clime I can't determine,
> That lifts its paws most parson-like, and thence,
> By simple savages—through sheer pretence—
> Is reckoned quite a saint amongst the vermin,"

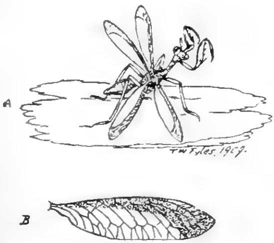

FIG. 17. (*a*) Mantispa brunnea; (*b*) Wing of M. brunnea much enlarged to show the venation.

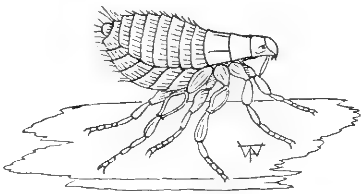

FIG. 18. Bat Flea.

so, *Mantispa brunnea* lifts its paws, with sweet "petitionary grace," lying in wait amongst the flowers. When *Argynnis myrina,* or some other incautious innocent butterfly comes within its reach, *M. brunnea* secures it with its outstretched arms—which are truly arms of offence.

Acholla multispinosa is a creature of like habits to *M. brunnea;* and its fore limbs are set thickly with sharp spines (hence the name), which enable it the more readily to secure its prey.

But the most remarkable of the three species is, I think, *Phymata erosa.* This insect in its colours closely resembles the flowers of the Golden Rod in which it lies in wait. On occasion, the tarsi of its extended fore-legs spring back into a toothed groove in the large and powerful tibiæ, and hold a captive as in a vice.

In *Dytiscus Harrisii* the upper portion of the foot in each of the fore-legs is expanded into a disk or pad, supplied on the under surface, with suckers which exhaust the air, so that the insect can attach itself firmly where it is inclined.

These appendages are not found in the female. Moreover, while the male Dytiscus is remarkably smooth and slippery, the female is roughened with striæ.

In *Acilius fraternus* a like provision is found in the foot of the male, to that in the foot of the male Dytiscus; and in this species also the female has roughened elytra.

The powerful hind limbs of the insects that have been named SALTATORES, such as the crickets and locusts, are worthy of observation. But other insects beside these Orthoptera have great powers of leaping:—

On the 24th of May of this year I was sitting on the veranda of Mr. Garrioch's house, on Front Street, Hull, when I saw a bat fall from a tree on the lawn. The little animal was in a very weak condition. While I was examining it I saw a flea creep from the fur, and then bound upwards one hundred times its own height. (If an acrobat could leap 600 feet into the air, he would draw multitudes to witness the feat.) (Fig. 18.)

I put the bat in a box, and obtained from it *thirteen* other specimens of the same kind of flea. No wonder the little animal was in a weak condition.

This *Pulex vespertilionis* was different from *P. irritans* and *P. serraticeps.* It was about two millimetres long. Its dorsal parts were of a light chestnut colour, and its ventral parts of a pale amber. The legs were translucent. The trocanters were grooved. The femur in each of the middle and hindmost legs was large, flat, and cleaver-shaped. Around it, near the edges, was a slight indentation. The tibia was striated and bristly. The tarsus had five joints with two bristles at each joint. The abdomen was hairy.

Of the wings of insects, fine examples of venation are afforded by the water-flies *Pteronarcys proteus* and *Polystoechotes punctata;* of elegance of form by *Actias luna and Hyloicus chersis*—and of splendour of colouring by *Philampelus achemon* and *Plusia balluca.*

THE ABDOMEN. How great a difference there is between the telescopic ovipositor of the house-fly which is concealed in the abdomen of the insect, but can be extruded by pressure, and which is fitted to penetrate the manure from the stable in which the larvæ of the fly luxuriate—and that of *Thalessa lunata,* which in some instances extends for four inches beyond the extremity of the abdomen, and is fitted to be passed along the tunnel, choked with frass, at the end of which the larva of *Tremex columba* is working. The young larva of Thalessa follows up and preys upon the larva of the Tremex.

The ovipositor of the last named insect proceeds from the middle of its abdomen, and not from the end. It is shorter and stouter than that of Thalessa, and is adapted to penetrate the bark and white wood of the trees suitable for the sustenance of the larvæ of its species.

THE EGG. Some years ago I found a huge boulder in a swampy wilderness. In a slight hollow, in the top of this, some vegetable mould had accumulated; and a thick pad of moss covered it. On lifting the moss, I found some hundreds of eggs of the Red-legged Locusts packed together in the soil. The locusts had found in the position a suitable nursery for their young.

The life of the Day-fly is very brief—as its name implies. It does not allow much time for oviposition. One act of extrusion consigns its eggs, in a boat-shaped mass, to the surface of the water.

The Cockroach frequents the house, but is highly objectionable to the housekeeper. Its eggs are laid in brown packages—oöthecœ—in the crevices about the kitchen-ranges and the cellar-furnaces. In these they escape notice.

The ovipositor of the Domestic Cricket has a divided sheath—each half of it having a spoon-shaped termination. When closed these terminals hold the egg, as in a casket, till a fitting nook for its deposit is reached; and then, they open and discharge it.

The cat shakes the eggs of the fleas that infest it into the lap of its mistress, or upon the rug on which it sleeps. The larvæ of *Pulex serraticeps* feed upon the particles of food that they find in the cracks of the flooring of the dwelling-place—but if the sheep-tick were to lay eggs that could be shaken from the wool of the sheep, her progeny would perish. Against such a contingency she retains her young till it reaches the pupal stage. The abdomen of the tick is unsegmented, and vellumy, and therefore very strong.

THE LARVA. The resemblance by which some species of Lepidopterous larvæ deceive their foes, and the threatening attitudes assumed by others, to drive their enemies away, are very familiar to all of us. But the very remarkable provision for the safety of the larvæ of *Harrisimemna trisignata* is not so well known.

And here we must call to mind that many caterpillars—those of *H. trisignata* among them—when undergoing the usual moult, withdraw the head from its old case, at its junction with the second segment—at the neck-opening—as a knight of old withdrew his head from the helmet. I raised a brood of larvæ of *Anisota virginiensis* last season. With them the head case was hard and black; but the head when it was withdrawn was soft and green. However, it speedily became rigid and dark as before.

FIG. 19. Harrisimemna trisignata. (Walker).

Now in the case of the grotesque larva of *H. trisignata* (Fig. 19)) on the thoracic segments there are some long stiff hairs which seem to have lain under the skin before the previous moult, and to have been attached, by their tips, to the inner side of the head cover. When the change of skin took place the hairs were erected, retaining their hold upon the head-case. At the slightest disturbance the larva agitated the bristles and the attached case is swung backwards and forwards with great rapidity.

I raised this insect some years ago, and subsequent observation has convinced me that we may see in this a natural provision, to protect the larva from troublesome ichneumons.

Cassida viridis appeared in this country a few years ago. It feeds on the Burdock and lies exposed on the plant. A curious provision is made to preserve the larva from the heat of the sun, and to render it unattractive to predacious insects and birds. By a fork-like appendage to the anal segment, the *fœces* are retained and supported over the dorsal parts of the larva, and form a protective wad, or shield.

THE PUPA. In the month of September, larvæ of the Saw-fly, *Cimbex Americana*, may sometimes be seen curled up, helix-fashion, on the ground, under the trees on which they fed. It will generally be found that they are parasitized—victims of *Opheltes glaucopterus.* They may have strength remaining to enable them to creep into some retreat; they may even attempt to spin the cocoon in which under normal conditions, they would spend the winter months; but they fail. Within them is the foe that is exhausting their vitality. This creature undergoes the pupal change within the frame of its host, and, at length, bursts from it as a perfect fly.

The fine ichneumon *Trogus fulvipes* undergoes the pupal stage within the pupa of the beautiful butterfly *Papilio troilus.*

I may cite the following as a remarkable instance of the instinct of a larva about to undergo the pupal change:—There was a needle-book, formed of alternate leaves of white and golden flannel, lying open on a shelf in my study. One night a larva of *Samia cecropia* escaped from the box in which it had been brought to me, and disappeared. Sometime afterwards I found that it had spun a cocoon in the needle-book, and had fastened a white fold on one side of its cocoon, and a yellow fold on the other. To disguise its work more effectually it had secured in the meshes of the cocoon, frayings of the white flannel on the one side, and frayings of the yellow on the other.

Volumes might be written upon the adaptations in structure which fit the insect for its environment, which enable it to supply its wants, and which ensure the perpetuation of its species. The Naturalist delights to look into these things. Considering them he feels, as David felt, that the Divine Designer of the Universe "hath so done His marvellous works that they ought to be had in remembrance."

"The melancholy days" have now come—"the saddest of the year;" but we still can find pupæ of insects in their snug retreats; and we know that, when "Heaven shall repair her rural seat," objects of beauty will burst from cocoon and chrysalis, to gladden the hearts of the beholders.

THE ACARINA, WITH A HOST INDEX TO THE SPECIES FOUND IN ONTARIO.

BY TENNYSON D. JARVIS, ONTARIO AGRICULTURAL COLLEGE, GUELPH.

There is probably no more widely distributed order of Arthropods than the Acarina; in economic importance there is none of greater value; and within the range of the whole animal kingdom there is no study so varied and fascinating as that of the Acarids, commonly termed Mites. The relation of these to other Arthropods has never been clearly defined, but in many respects they bear a close

resemblance to Spiders and Scorpions in the Arachnida, and by the best authorities have been put in one order of this class.

However, in structure they are so unlike and in habits they are so varied that one never loses interest in his researches. Perhaps one of the most interesting features in the study of mites is shown in the manner in which they protect themselves against their enemies by special adaptations. The species belonging to the genus Nothrus are found on the bark of spruce and pine and appear in colour and shape like tiny bits of bark and lichen. A species of Analgesid, found on the wings of the Baltimore Oriole, presents precisely the same shade as the feathers of the wing. *Tetranychus spinosa,* which feeds in the upper surface of the leaf of the basswood, is identically the same colour as the leaf, and the writer found it impossible to detect the difference except by use of the microscope.

In the Gall Mite family the young mites are almost as translucent as are the trichomes, but when with age these trichomes turn brown and then black, the mites also assume the same colours in the same manner. Any number of similar examples might be mentioned if space permitted, but sufficient has been said to indicate the adaptation of these animals to their colour environment. Another species of Nothrus may be mentioned as demonstrating protection from dryness and heat. In this case the mite accumulates a covering of dust upon its back. Similarly at the approach of cold, the mite surrounds itself with particles of any substance within reach. Further illustrations of adaptation to environment are seen in a species of mite found upon the roots of Yarrow, with legs broadened, mole-like, fitting it for digging and burrowing in the earth. In the genus Cheyletus, the palpi are large and branched, fitted for grasping, and the mouth parts are long and piercing, providing the mite with suitable weapons for a predaceous life. Aquatic species are greatly modified forms of land mites, with flat and hairy legs, enabling the mite to propel himself quite freely in the water. The parasitic mites attacking all kind of animals have many special devices for attaching themselves to their host and adequate provision for obtaining nourishment from the body of the victim.

The curious shapes and odd looking appendages found in many of these creatures appear to the observer to be more ornamental than useful. The bird mites with their angular construction and long tail-like appendages afford the best examples of this class. The sugar mite *Glyciphagus* with its fan-like attachments is another instance of apparently useless equipment.

In richness of colour and beauty of marking, the Tetranychids and Analgesids are most noticeable. Indeed, some of these handsome species are worthy of the attention of any one interested in the field of Nature. Among the most remarkable phases of animal architecture are the abnormal constructions of vegetable tissues produced by species belonging to the family Eriophyidæ. About seventy different species of these worm-like creatures inhabit trees, shrubs and herbs of Ontario flora.

Not the least wonderful of the habits exhibited by the Acarids are their modes of distribution. As will be shown in our discussion of the dung beetles, many species of the scavenger mites make use of dung beetles and flies to bear them to new feeding grounds. A few species are specially provided with a cord, secreted by glands in the body, by means of which they fasten themselves to their carriers.

Another interesting feature in this connection is their friendship to other animals, a few species sharing the home of many of the common species of ants. Here we find the ants repaid for their hospitality to the homeless mites by having

their quarters kept in cleanly condition by getting rid of the cast-off skins which are largely devoured by these active little scavengers.

Because of their relation to disease, their parasitic habits upon man, animals and plants, and their beneficial effects as scavengers, it is hard to over-estimate their importance. There are at least eight well-defined diseases of man and domestic animals, all isolated within the brief period of five years, which are transmitted from host to host by means of these mites. Numerous species spread the spores of bacterial and fungous diseases from affected organisms to healthy plants. As animal parasites they are found upon insects, crustaceans, mollusks, fishes, amphibians, reptiles, turtles, birds and mammals. As plant parasites, almost every known plant is attacked by one or more of these hungry mites; and as scavengers they are found on all decaying matter. In spite of their vast importance, not much has hitherto been done in Canada in working out the different species and determining their habits. This is in part due to their very minute size and also to the difficulty in locating them. For the little we do know, we are indebted to Mr. J. B. Tyrrell, of Ottawa, for his investigations on Analgesids, and to the late Dr. Fletcher for his contributions on the habits of some of our common species of vegetable pests. In the United States much has been done in a systematic way by Mr. Nathan Banks, Bureau of Entomology, Washington.

The species in the list outlined in this report were in almost every case collected in the vicinity of Guelph. This study was first taken up in 1904 and since that time the writer has collected, examined and studied to some extent the habits and characteristics of upwards of three hundred species, one hundred or more of which are new and many of them belonging to genera new to North America.

Mites are known to exist and to cause trouble in every part of the world, but in the temperate zones the largest numbers of species abound. Usually they are found in semi-dark localities, but a few species seem to enjoy full sunlight, being found upon the upper surface of leaves. On account of their minute size, certain species can be obtained only by use of special devices, such as mite traps; others again, such as bird mites, which are nocturnal in habits, must be gathered at night; still others, as the Eriophyes, which closely resemble their surroundings, require several days of constant search. Special emphasis should be laid upon the construction and operation of the mite traps. The trap consists of a copper cone-shaped vessel lined with tin, affording a smooth surface, to prevent the mites from attaching themselves to the sides of the cones. Within the body of the outer cone are four smaller cones, to the ends of which are attached small bottles, and in these the material under examination is placed. The outer vessel is then filled with water at a temperature much higher than the normal habitat of the mites. The discomfort thus produced causes the mites to leave their host or habitat, and as almost without exception, Arthropods when disturbed travel downwards, they slide down the smooth inner surface of the cone into the bottle below, where they are readily available for examination. Sometimes they are preserved in alcohol, sometimes mounted in glycerine jelly or balsam, and if intended for life history study they are transferred to artificial media.

The aquatic apparatus is made of the same materials as the terrestrial one, viz., tin and copper. It works upon much the same principle as the one just described, *i.e.*, when an Acarid becomes uncomfortable the tendency is to go downwards. But instead of applying heat as in the case of the land trap, a few drops of formalin or alcohol is added to the aquatic material. The trap with the proper fittings may be taken to a pond or stream where various kinds of material are available, and in the course of a single day's work many species may be captured.

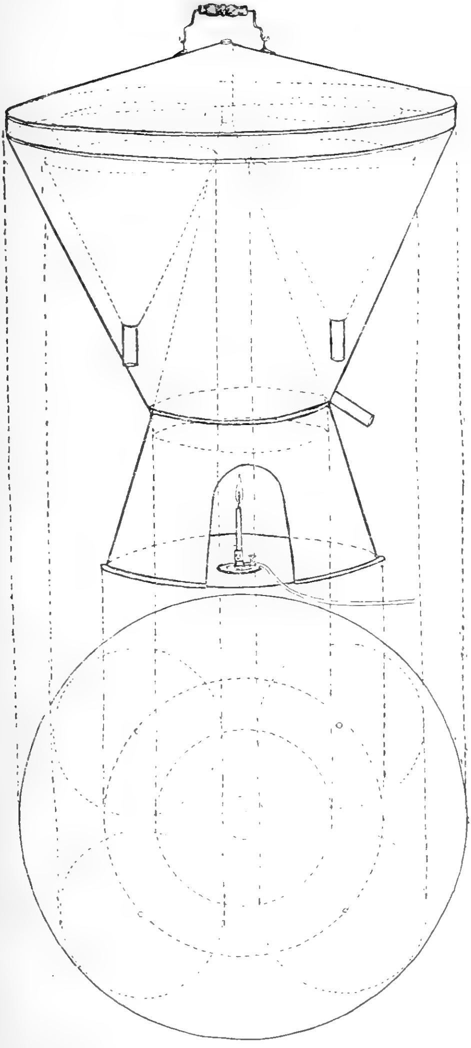

FIG. 20. Apparatus for collecting small terrestrial Arthropods.

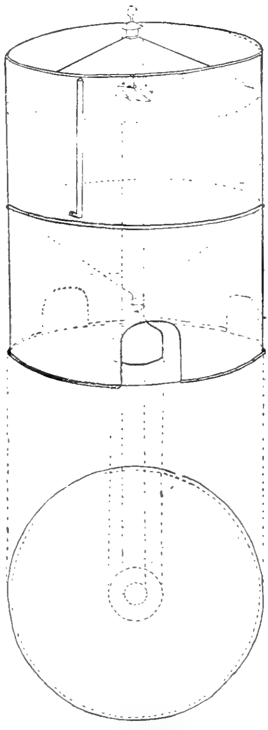

FIG. 21. Apparatus for collecting small aquatic Arthropods.

At the College over one thousand kinds of material were examined and almost all were found to contain one or more species of mite, in some cases as many as twelve different species were procured from a single substance. To give some idea of the kinds of materials tested, we might mention the following: manure, moss, decaying vegetables and leaves, dead and living animals, herbaceous plants, bark and leaves of trees, tubers, bulbs and roots, bone, stone, nests of birds and mammals, soil, pine and spruce cones, ensilage, fleshy fungi, all kinds of grocery commodities, clothing, fruits of all kinds, and sawdust.

Some of the living mites obtained from the mite machines were transferred to pure cultures in order to study their habits and life history. It was found that on proper media it was possible to keep them alive through several generations. Some of the media used are as follows:—First, for living animals—mosquito pupa extract and beef peptone. For living plants—extract of the same plant and on the living host plant. The extract of the plant was made by using two parts by weight of water to one of plant material, and the two heated one hour in a sterilizer and filtered. For mites living on dead matter, the cultures were made in three ways, first, for mites living in nitrogenous substances the culture consisted of whey-peptone, whey 80 per cent., agar 10 per cent., and gelatin 10 per cent. Two other cultures for the nitrogenous feeders were cheese extract and beef extract. On saccharine and acid fruits the media consisted of apple juice. On vegetable matter a culture of potatoes and potato extract gave best results.

The gratitude of the writer cannot be too strongly expressed to Mr. Nathan Banks, Acarologist of the Bureau of Entomology, Washington, for his able and ready assistance in identifying a large number of species sent to him, and to Messrs. W. R. Thompson, B. Barlow, George Chadwick, Geological Hall, Albany, N.Y., and Dr. Bethune, for assistance rendered in various ways.

I.—HABITS OF THE CLASS ACARINA AS AGENTS IN THE TRANSMISSION OF DISEASE.

Spread of Bacterial and Fungous Diseases.

In pathological and bacteriological laboratories, mites are a great nuisance by inoculating pure cultures. Four species were found at the Ontario Agricultural College,—*Tyroglyphus Americanus* and *T. longior* feeding upon non-nitrogenous media, and *Cheyletes clavispinus* and *C. longipes* feeding on nitrogenous cultures. They make their home in the incubators, and gain entrance to the pure cultures through the cotton wool in the test tubes and between the fittings of the Petri dishes. The spores of bacteria and moulds attached to the appendages of the mites are left behind in the pure cultures, where they multiply rapidly and cause no end of trouble.

The spread of bacteria and moulds in root houses is not duly appreciated. More than a dozen species have been found at Guelph inhabiting turnips, beets, carrots, mangels, parsnips, potatoes, spreading spores of affected roots to healthy ones. Especially noticed in cellars of this kind are *Galumna moesta, Rhizoglphus phylloxerae* and *G. depressa* on turnips; *Oribatta depressa* and *T longior* on mangels and turnips, and *Gamasus* species on sugar beets and on parsnips, potatoes, celery, etc. On fruit trees the spread of brown rot, cankers, pear blight, etc., are carried to a large extent by such species as *Tetranychus telarius, T. bicolor, Bryobia pratensis, Oribatella pallida,* and *O. formosa.*

Here it might be mentioned that the fruit grower may do much in the way of avoiding diseases of the kind mentioned by frequent applications of the common insecticides.

In Grocery stores cleanliness cannot be too strongly emphasized, as this is one of the favourite resorts of mites. A few examples of the spread of bacteria and fungi will give an idea of their destructive habits to the groceryman. They crawl underneath the lids of manufactured jams and jellies, carrying with them spores which multiply and bring about putrefaction. In dried fruits, sugar, and other sweets, flour, bread, cheese, etc., they carry a number of species of moulds and often cause tremendous loss, which might easily be avoided if the proper care were practised. *T. longior, T. Americanus, Aleurobus forinae, Carpoglyphus sp.* are examples of Grocery pests.

In horse stables and other buildings, mites are found abundantly, especially where imperfect lighting and cracks and crevices of concealment are features of the buildings. *T. longior* might be mentioned as the commonest house mite. It is found from cellar to attic and practically on every object, thus we see the probability of its spreading spores of bacteria and fungi. The ensilage mite which makes its home in the silo is a good example of a stable mite. It, no doubt, spreads spores of some of the numerous bacteria and fungi found in ensilage. Another example of how mites may spread disease from stable to house is the case of the house-fly mite which travels on the backs of flies and may be transported from the manure of the stable to the food in the pantry, *e.g.*, *Histiostoma Muscarum.*

Spread of Protozoan Diseases. Nearly all of the diseases belonging to the genus Piroplasma are transmitted from animal to animal by means of these ticks or mites. In the United States there are two very well known pathogenic diseases which belong to this group. The Texas Fever (*Piroplasma bigeminum*) and Spotted Rocky Mountain Fever (*Piroplasma sp.*) In Asia and Africa six other well known diseases, *Piroplasma ovis* of sheep, *P. canis* known as Piroplasmosis of dogs, *P. equi,* Piroplasmosis of the horse, *Piroplasma Sp.*—Rhodesia fever, and *Haemoglobinurina* of Finland. Space will not permit of discussion of this important phase of the subject. At present we have no record of any diseases spread in this manner in Canada, but since we have here numerous species of ticks associated with animals it is not unlikely that in time we shall find examples of diseases carried in this way.

As Parasites of Animals.

Man.—Among the mites that are injurious to man might be mentioned, first, those that are parasitic and spend the whole of their existence in the host; second, those like the ticks that are casual visitors; and, third, those that inhabit his house and clothing and cause annoyance by their presence. The first is exemplified in the follicle mite which lives on the secretions of the follicles of the skin, such as *Demodex follicularum* and the "Jigger" of the Southern States. Examples of the second class are the numerous species of ticks. These are found in the tropics, and are abundant in fields, woods and pastures. They leave the herbage to attach themselves to man and other animals, where they burrow into the skin and create considerable irritation. In Ontario ticks are not so abundant, but in some parts the wood tick leaves its common habitat to attack man in the way just described. The harvest mites, found in grass, hay and cereal crops, when found in large numbers also cause much irritation. The species known as *Carpoglyphus passularum* found in sugar in grocery stores often leaves the sugar to attack man, causing what is known as grocer's itch. The most common species found in

houses are the Clover Mite (*Bryobia pratensis*) and the Cheese Mite (*Tyroglyphus longior*). The Clover Mites often swarm in houses in the fall of the year, where they frequently hibernate through the winter. They get into the cracks and crevices of chairs, windows, doors, etc., and cause great annoyance to the occupants of the house. The Cheese Mite is even a more serious pest, intruding itself into all the darker parts of the house. It is found in the cellar, on fruits, tubers and other food products; in the pantry on cheese, butter, flour, meat, pastry, etc.; in the wardrobe, particularly on worn and stained clothing; in the library on the paste of the book bindings; in upholstered furniture in all the niches and hollows where they can conceal themselves. Still more annoying is their habit of crawling from the clothing to the body, and in many cases, while not actually on the person, the imaginary discomfort is just as effective. The species is not parasitic. Fumigation with hydrocyanic acid has given fairly satisfactory results as a remedy for this mite.

Domestic Animals. Most of the injurious parasites of domestic animals, such as sheep scab, mange, ticks, follicle mites, belong to the Acarina. The sheep scab caused by the mite known as *Psoroptes communis*, var. *ovis*, is a serious disease of the sheep throughout the world. In Ontario it has occurred in Manitoulin Island and a few other parts, but by proper precautions it has either been exterminated or kept in check. They live in the skin, and obtain blood or lymph as food from the host, and in this manner give rise to considerable irritation, resulting in inflammation, scab formation, and finally in loss of wool and hair. The best treatment consists in using some external applications, such as dipping, which will kill the parasites.

The disease known as mange is caused by species belonging to two different genera, Sarcoptes and Chorioptes. The Sarcoptes when young burrow in the tissue, where they feed and develop. The species of Chorioptes do not burrow in the skin, but produce a scab similar to sheep scab, but it is restricted to certain parts of the animal, as the feet, the ears and the neck. A species of Sarcoptes causes eruptions and inflammation of the skin of horses, which becomes intensely itchy, the animal at this stage refusing food and becoming much emaciated. A species of Chorioptes is found on the horse, cattle and goat, the one attacking the horse being the most common.

Scarcely any of the domestic animals escape the attacks of the mites known as ticks. The ticks are large mites with tough, leathery skin, and possessing mouth parts fitted for sucking and legs fitted for holding on to the host. They are true external parasites and cause much annoyance by getting into the ears, around the eyes, and other places where they can avoid the efforts of the animals to dislodge them. They are most abundant in the tropics, but a few species are native to Ontario, and others again, such as the Southern cattle tick (*Boophilus bovis*), are imported to this country along with the stock.

The follicle mite of swine (*Demodex phyloides*) is the chief member of the mite class attacking swine. They live in the follicle and cause white tubercles on the skin from the size of a pin-head to that of a pea.

Wild Animals.—These, of course, are not of so great economic importance, but when further studied they may be found to play a part in the transmission of disease from wild to domestic animals or man. It is astonishing to find on some animals such vast numbers of these pests. The ground hog is especially a victim to a number of species. The muskrat, the squirrel, the bat, the mole, the mouse, the

moose and deer all must suffer considerable annoyance from the presence of these pests. In the study of this group several new genera were established for North America.

Only a few amphibians were examined, and on one, the Leopard frog, a species of Gamasid was found in abundance attached to the skin, apparently doing no harm, but perhaps considerably annoying its host.

Several Ontario reptiles were examined, but the writer found no indication of parasites at work. However, in the United States an interesting species of tick has been known to attack snakes.

Practically all the domestic birds suffer from the attacks of one or more species of mite. The chicken mite, *Dermanyssus gallinae,* is the commonest and most destructive pest of poultry. It is noctural and rests during the day in the crevices of roosts and nest boxes and other places of concealment. It multiplies rapidly and, unless checked by insecticides such as kerosene, will soon ruin a flock of poultry. An interesting species is found in the nasal chambers of domestic and wild birds. The injury they do has not yet been fully ascertained, but in many cases where they are very numerous they cause suffocation by choking the nasal passages. In Rhode Island a species of mite has been found in the air sacs of turkeys in every part of the State. It is again doubtful in this case as to just how much damage they cause. On the pigeon several species are found, some attacking the feathers, some the skin and others the legs and feet. These are only a few examples of the many species found on domestic fowl. It might also be mentioned here that through the agency of large shows, as the International held in Canada and the States, the tendency will be to exchange and distribute the various species of North America.

Our native birds are among the most favoured by the mite pests. In our study so far, we have found over fifty species in Ontario. Their habits vary, some living parasitically, such as Liponissus sp.; others symbiotically as in case of Analgesids; and still others merely as guests. Since many of our common birds associate and feed with our domestic birds, they may easily pass from one to the other. These again are of little economic importance so we need not discuss them further.

Fanciers of caged birds are not exempt from troubles arising from the attacks of these parasites. A species known as *Dermanyssus avium* is very common everywhere caged song birds are kept. Their habits are similar to those of the chicken mite, hiding in crevices of the roosts by day and sucking the blood from their victims at night.

As Parasites and Guests of Insects and Other Mites.

A striking example of the manner in which mites assist in maintaining the balance of nature is afforded by these parasitic and predaceous creatures. It is a well known fact that many of our most injurious insect pests of fruit, garden and farm crops are controlled more effectively by the Acarids than in any other way. A notable example of this kind is found in the Locust Mite, *Trombidium locustarum.* The mite is generally found attached to the base of the second pair of wings, although it is also found on the wing itself and on any other part of the body, where it cannot be easily detached by the locust. A favourite position upon the body is between the segments of the thorax and abdomen, and also behind the upper joints of the legs, in such position their only means of attachment to their host is apparently by their mandibles. As many as a dozen or more of these mites may be found upon a single insect. These little mites render good service in

checking the spread of locusts, as almost every locust upon which one is found appears to be feeble and sickly. Another species, *Celaenopsis latus,* attacks the larva of *Passalus cornutus,* and still others, attacking garden pests are found on the larva of Lachnosterna. Attacking fruit tree pests may be mentioned *Hemisarcoptes malus* on San José Scale and Oyster Shell Bark Louse; *Rhyncholophus sp.* feeding on San José and New York Plum scale; *Cheyletes pyriformis* on the larva of the Codling Moth. On forest tree insects we have a species destroying the Cottony Maple Scale and another species attacking the Maple Plant Louse. On household pests we have *Histiostoma muscarum* parasitic on the house-fly and other species on mosquitoes. The mites themselves are largely kept in check by predaceous and parasitic species belonging to this group. *Sejus macrophylus,* found in the Aspen *Eriophyes* gall, and *Gamasid* species attacking Pear Leaf Blister mite. Here we might also mention that a large number of the aquatic insects are parasitized by Hydrachnids (water mites). Besides the species found preying upon insects there are a large number which attach themselves to the body of the insect without causing any apparent harm or annoyance. Examples of these are the following:

Uropoda sp. on Rough Osmoderma, Cerambycids, Skin Beetles, Tumble Bugs, Darkling Beetles, etc.; and *Macrocheles sp.* on Carrion beetles, Silpha, and Horned Passalus.

As Parasites of Water Insects.

The water beetles and bugs are mostly parasitized by a species *Hydrachna belostomae* which attaches itself to the ventral surface of the Electric Light bug.

As Parasites and Guests of Mollusks.

A number of species of water mites have been collected from the gills and attached to the bodies of bivalves but the identification of these have not yet been completed.

As Scavengers.

As a means of elimination of waste materials, there is probably no more effective agent than the mites. There is no kind of filth or decaying matter which is not relished by some species or other of the Acarids. In manure, sewerage, decaying vegetable matter, decaying animal matter and all forms of dirt, mites are to be found actively engaged.

Of Manure. Samples of nearly all kinds of manure were used in the mite machine, and in almost every case mites were obtained. *Histiostoma valida* is a common example in horse manure.

Of Decaying Vegetable Matter. Decaying potatoes, mangels, turnips, parsnips, carrots, kohl rabi, corn stubble, cabbage, lettuce, decaying leaves, humus in the soil, sawdust, rotten stumps, fleshy fungi were all found to be hastened through the stages of decomposition by these busy creatures.

Of Decaying Animal Matter. Almost every particle of thrown-off material from the animal body such as epidermal scales of birds and mammals, moulted skins of insects, are readily consumed by some species of these scavengers. Bone, horn, flesh and hair are also their foods, and it is next to impossible to find a single bit of any of these substances without finding along with it certain kinds of mites.

Of Mineral Matter. Mites were found upon rock and stone in all cases of weathering, in every little crevice where the wearings from the rock had lodged.

Again, specimens were found even in the solid rock, where, without any apparent means of sustenance, these active little creatures seemed to thrive. An example of this species is *Scutovertex petrophagus,* found at Trahanic Falls near Ithaca, N.Y.

Bush and Fruit Tree Pests.

In Canada and other countries mites that attack bush and fruit trees are among the more serious pests of the fruit growers. In Canada they are found on the apple, plum, pear, etc., and in tropical countries they are very destructive to citrous fruit trees. Examples attacking the apple tree are the Pear Leaf Blister mite, *Eriophyes pyri,* which is widely distributed throughout most of the apple growing region. They form red blister-like spots about one-fourth of an inch in diameter, which turn brown in late summer, the tissues becoming hard and corky. Three or four other species belonging to the genus Eriophyes have not such economic importance. The same species found on the apple are found attacking the pear and other trees belonging to the genus Pyrus. Another injurious species attacking the plum tree in the Niagara district is the Plum Twig Gall mite, *Eriophyes phlœocoptes.* It is an European species which has been imported into this country within recent years. The mites form small sub-spherical galls in clusters at the base of the buds. Pocket-like galls belonging to the genus Eriophyes are found on the leaves of the cherry, plum, and grape. Two species of red spider, *Tetranychus telarius* and *Bryobia pratensis,* are found on the under side of the leaves of the plum, pear and apple, and when in large numbers, as they usually are in dry seasons, they do a considerable amount of injury to the common fruit trees. One species confines its ravages to the secretions on the surface of the apple. The red spider is also found on the raspberry. On currant bushes in England a species known as the Black Currant Gall mite, *Eriophyes ribis,* has long been known to horticulturists in that country, and as it is spreading rapidly in England and other countries, its presence here may be expected any day. In shape this particular species is easily recognized by the distinct globular or swollen-like appearance of the buds. When the buds are badly attacked they never open into leaf, but for a time they retain their green colour, later becoming brownish, dry, gall-like bodies, more or less open at the apex. Another species of considerable economic importance in the tropics is *Eriophyes oleivorus,* the rust mite of the orange and the silver mite of the lemon. It occurs in California and lives on both leaves and fruit. On the foliage the mite causes the leaves to become curled and to lose their gloss. On the fruit of the orange the mite produces a hardening of the rind, which becomes brownish in colour. The infested orange, although injured in appearance, is better able to stand long shipment and is more juicy than the clean fruit. Upon the lemon the mites cause the rind to become silvered, the fruit is better for shipment but the rind is injured for commercial purposes.

As Pests of Farm and Garden Crops.

As enemies to the growing grain and also to stacked roots such as turnips, carrots, mangels, potatoes, and even ensilage, mites are considerably destructive. Yet they are not responsible for so much damage as they are often credited with. In the field the Clover mite, *Bryobia pratensis,* is of most importance, attacking clover and other leguminous crops. Another species is found on Timothy and causes distortion of the inflorescence. In the root cellars there are hosts of species too numerous to mention, some parasitic, some saprophytic, and a few finding it a favourite place to live, but doing no harm.

As Pests of Vegetable Crops.

Only a few species have been found, but the enormous numbers of individuals make up for the fewness of the species. Myriads of Tetranychids are found feeding on the leaves, and the Tyroglyphids are everywhere present on the stored roots. *Tetranychus telarius* is the most common species on the outside crop, and *Tyroglyphus longior* and *Gamasids* are most troublesome inside.

As Pests of Shade Trees and Ornamental Shrubs and Herbs.

Scarcely a tree or shrub escapes the attacks of one or more of these species. Some indeed, such as the maples, have as many as twenty-five or more species, feeding and absorbing nourishment from the leaves, twigs, bark, stem and roots. Most of the injuries of the trees are due to species of the Eriophyidæ, but in case of the shrubs and herbs the Tetranychids do most damage. The type of injury on the trees takes the form of galls. These are beautiful structures and at certain seasons of the year where they are not too abundant, appear more ornamental than destructive. As examples of these might be mentioned the Top Gall of the Soft Maple, the Pocket Gall of the Basswood, the Frost Gall (Erineum) of the Maple and Beech. On the shrubs we find the Tetranychus species again in evidence—the Privet, Garden Bell, Lilac, Spirea, Roses and Dogwoods. Among the ornamental herbs that suffer most from the attacks of Tetranychids are the perennial Phlox, Petunias, Nasturtium and Malva.

As Pests of Forest Trees.

The Ontario forest flora affords suitable hosts for over fifty species of gall-making mites. A few of the more important ones have been discussed under Shade Tree Pests, but a large number of the species are not met with except on forest trees. These variously shaped galls are found on the flowers, fruits, leaves, twigs, and stems of such trees as the Elms, Poplars, Willows, Oaks, Chestnuts, Hawthorns, Maples, Lindens, etc. They not only do injury to the development of the tree but cause unsightly vegetable deformities sometimes literally covering the tree. The Witches Broom of the Hackberry, Willow, etc., is also the result of the work of these mites. Much difficulty is experienced in treating the trees for these pests as they are protected by the tissue of the gall which forms around them. The lime-sulphur wash which is found most effective for the Pear-Leaf Blister mite is about the best remedy where it is practicable to spray. Red Spiders of the Tetranychus genus almost equal the Eriophyes in abundance on forest trees. Only a few species have been determined but the excessive numbers of these species which are found make up for the fewness of the species. When closer study is made of this genus, it is altogether likely that a far larger number of species will be discovered. *Tetranychus spinosa,* which is found on the Linden on the upper side of the leaves is often sufficiently abundant to consume the whole of the chlorophyll, changing the appearance of the tree from green to yellow in midsummer. *Tetranychus bicolor* produces the same effect on leaves of Oaks and Hawthorns as *T. spinosa* does to the Linden. *T. telarius* is also found on the leaves of many forest trees.

As Greenhouse Pests.

The florist is only too familiar with the work of the Red Spider and the Bulb mite, which are invariably present in large numbers attacking most of his flower-

ing plants. Two species of Red Spider, *Tetranychus bimaculatus* and *T. telarius*, are the common species of the greenhouse of Ontario. They are found on such plants as primulas, chrysanthemums, carnations, cinerarias, tomatoes, etc. The bulb mite, *Rhizoglyphus hyacinthi*, is responsible for an enormous amount of damage in hothouses. They burrow into the healthy tissue, thereby giving a chance to the destructive soil bacteria to bring about decay. It is found on hyacinths, narcissus, orchids, and other bulbous plants. Affected bulbs should be burned as soon as the mite is discovered. *T. pallidus* is sometimes found on leaves of Chrysanthemum and *Rhizoglyphus heteromorphus*, which cause injury to the stems of carnations, are found in New York state. Other species are found on the pistil of Banana flowers in the tropical greenhouses, and on the leaves of Latania palm.

As Pests of Flour Mills, Stores, Etc.

Flour mills, grocery stores, drug stores, butcher shops, libraries, laundries, restaurants, confectioneries, seed stores, furriers and furniture stores all afford hospitality to a species or more of Acarid. The flour mites, *Aleurobius farinae* and *Tyroglyphus longior* are the chief pests of the flour mill, the grocery store, the seed store and confectionery store. The sugar mite, *Carpoglyphus passularum* is chiefly found on raw sugar.

II.—CLASSIFICATION.

The mites belong to the Phylum Arthropoda, to the class Arachnida and to the order Acarina. In a general way mites are readily identified by their one-piece or sac-like bodies, but a much greater difficulty is encountered when it comes to differentiate them from their allies, the spiders and scorpions. Scorpions have segmented bodies and spiders have a marked constriction between the cephalothorax and the abdomen, and when these characteristics are present they can be easily separated from the Acarids. They are mostly very small and some are even microscopic. It has been found that in the embryo eight legs are present, but at birth and during larval development they have only six, and after moulting a few times develop a fourth pair. Exceptions are found in the large family, Eriophyidæ—the worm-like mites—where they have but two pairs throughout life. The legs are provided with hairs and spines, sometimes much modified, fitting them for special adaptations in life. In some groups organs are found on the anterior legs which are supposed to be sensory. The last joint of the leg is commonly terminated by from one to three claws. The mouth parts take the form of a truncate cone or beak, and in some families it is partially or completely reversible. The mandibles and palpi are of various types and peculiarly modified according to the habits of the mite. In some families there is a lingula or tongue which is usually not visible except by careful examination, but in the Ixodidae it is large and roughened with sharp teeth. On the cephalothorax there are usually one or more pairs of simple eyes which are sometimes elevated on short pedicels. The reproductive organs open on the ventral surface of the abdomen, and in this respect they are like their relatives, the Arachnids.

Family Eupodidae.

Only three species have been found in Ontario. In chopped grain, under bark of wood and under boards are the principal habitats of this family. They are predaceous, soft-bodied, small mites with very long legs, and mandibles cheylate like their relatives, the Cheyletidæ. In many respects they are primitive in that they possess characters similar to those of the spiders.

Eupodes variabilis. Found abundant on barley seed in experimental grain cellar. T. D. J., Guelph.

Eupodes sp. Found under bark of Ironwood associated with other sp. of mites. T. D. J., Guelph.

Linopodes attenuipes Bks. Found under boards on College campus. T. D. J., Guelph.

Family Bdellidæ.

There are also three species of this family found in Ontario. Under bark of balsam, crabapple, soft maple, apple, hard maple, in mangel seed, cavities of stone and in ground spelt in Experimental grain cellar, are some of the places inhabited by this family. They are closely related to the Eupodidæ and Cheyletidæ in that they are predaceous with cheylate mouth parts and cephalothorax partially distinct from the abdomen. They are red in colour with long, slender legs and a well developed beak or rostrum.

Bdella cardinalis, Banks. Under bark of Balsam, Abies balsamæ, Crabapple, Soft Maple, Pyrus sp. In cavities in stone. T. D. J., Guelph.

Bdella tenella, Banks. Under bark of Hard Maple. In Mangel seed in the Experimental grain cellar. T. D. J., Guelph.

Bdella sp. Found in ground Spelt in Experimental grain cellar. T. D. J., Guelph.

Family Cheyletidæ.

This family is more or less largely represented in the Ontario fauna, containing eight species, some parasitic and predaceous upon birds, rodents, and insects. Other predaceous species may be found almost anywhere in search of mites and other insects. They are characterized by having very large palpi and are distinguished from the previous families by the absence of the demarcation between the cephalothorax and the abdomen.

Myobia caudata, Banks. Abundant on little brown bat. T. D. J., Guelph.

Myobia musculi, Derges. Found in abundance very closely attached to the hairs of the house mouse. T. D. J., Guelph.

Cheyletes pyriformis, Banks. Found on larvæ of Codling Moth in winter nest. T. D. J., Guelph.

Cheyletes longipes, Banks. Several specimens found in gelatin culture in Bacteriological laboratory., T. D. J., Guelph.

Cheyletes clavispinus, Banks. Several specimens were taken under bark of lilac. T. D. J., Guelph.

Cheyletes ferox. In hay, Ontario Agricultural College Barns. Mangel seed, Experimental office. Grain in grain cellar. Barley seed, O. A. C. barn. Ground Spelt, Experimental Department.

Cheyletielle Canadensis, Banks. Found on Bluebird, Sialia sialis. T. D. J., Guelph.

Sorergates sp. Parasite on house and field mouse in cavities or little cells just beneath the skin. J. B. T., Ottawa.

Family Tetranychidae.

Five species of this family have been found in Ontario up to the present time. These are distinguished from the three preceding families by being fitted for existence entirely on vegetable matter. Trees, shrubs, and herbs are usually infested with one or more species of this family. Both sides of the leaves are attacked by mites of this family, probably the under side being their most favourite resort. Greenhouse plants as well as outdoor plants are subject to their attacks. Several species are capable of spinning a silken thread and weaving a home, and from this habit are called spinning mites. The commoner species are red in colour and from this they get the name of "red spiders." Other species are found in green, brown, and mottled colours. They all have one or two conspicuous ocelli on the cephalothorax and the body and legs usually have a few long scattered hairs.

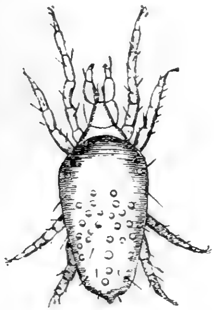

FIG. 22. Tetranychus telarius—"Red Spider."

FIG. 23. Trombidium irritaus—Harvest-mite.

Tetranychus telarius, L. (Fig. 22). Found under bark of Buckthorn (Rhamnus catharticus), Crabapple (Pyrus sp.). Cultivated Alder (Alnus glutinosa). T. D. J., Guelph.

Tetranychus bicolor. Feeding on upper side of leaf of Hawthorn (Cratægus) and Burr Oak (Quercus macrocarpæ). T. D. J., Guelph.

Tetranychus spinosa. On leaves of Basswood (Tilia americana). T. D. J., Guelph.

Bryobia pratensis. In houses. On window pane of Experimental basement, Ontario Agricultural College. On clover and plum. T. D. J., Guelph.

Tetranychus bimaculatus. In greenhouse. T. D. J., Guelph.

Family Rhyncholophidæ.

Four species occur in Ontario, all belonging to the genus Rhyncholophus. They are of much economic importance since most of our species are predaceous on scale insects. Most of our species are red in colour and possess very long legs.

Rhyncholophus pilosus. Feeding on eggs of Ichneumon; a parasite on Cecropia moth; found at base of old stump in woods; on apple tree feeding on Canker worm; on large black willow and other trees running over leaves in search of insects. T. D. J., Guelph.

Rhyncholophus parvus, Banks. Under leaves in woods. T. D. J., Guelph.

Rhyncholophus sp. Feeding on San José Scale. T. D. J., Guelph.

Rhyncholophus sp. Feeding on New York Plum scale. T. D. J., Guelph.

Family Trombidiidae.

Although only three species have been studied, one of them, *Microtrombidum locustarum,* is of great importance, as it is parasitic upon the eggs and adults of locusts. The "Harvest mites," as they are popularly called, are recognized by

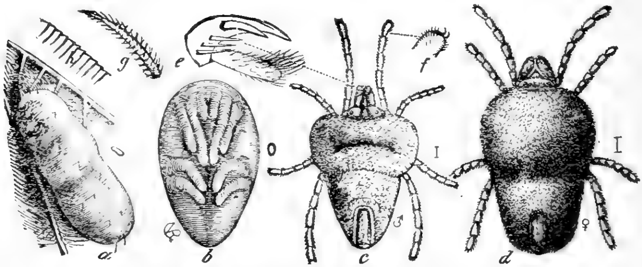

FIG. 24. Trombidium locustarum.—(*a*) mature larva, when about to leave the wing of a locust; (*b*) pupa; (*c*) male adult fresh from the pupa; (*d*) female—the natural sizes are indicated by the short lines on the right; (*e*) palpal claw and thumb; (*f*) pedal claws; (*g*) a barbed hair; (*h*) the striations on larval skin (after Riley).

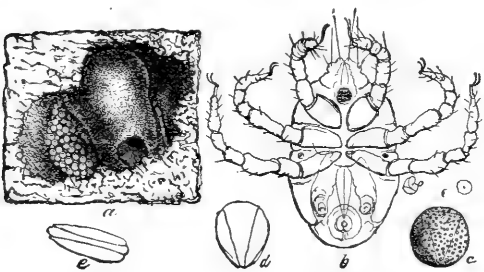

FIG. 25. Trombidium locustarum.—(*a*) female with her batch of eggs; (*b*) newly-hatched larva—natural size shown by the dot in a circle on the right; (*c*) egg; (*d*, *e*) empty egg-shells (after Riley).

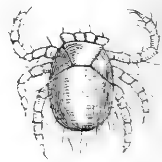

FIG. 26. Dermanysus avium.

the body being divided into two parts, the anterior the smaller and the posterior the larger. (Fig. 23). They are always red in colour and most of them quite large. The body is covered with a compact mass of bristles or branched hairs which gives them a velvet-like appearance.

Trombidium sericeum, Say. On decayed log; cedar moss. T. D. J., Guelph.

Microtrombidium locustarum, Say. (Figs. 24 and 25). Parasitic on several species of locust in all parts of Ontario. T. D. J., Guelph.

Trombidium sp. On eggs of Forest Tent Caterpillar.

Family Hydrachnidae.

Many species belonging to this family have been obtained by means of the aquatic mite trap, but so far only two species have been identified. They are closely related to the Trombidiidæ, but are distinguished from them by means of their flattened and hairy legs and other adaptations for their aquatic existence. The young of this family are usually parasitic on water bugs and beetles, but the adults, as a rule, live free in the water.

Hydrachna belostomae, Rie. Attached to ventral surface of electric light bug. T. D. J., Guelph.

Hydrachna sp. Gills of Fresh Water Mussel. T. D. J., Guelph.

Family Ixodidæ.

Five species of this family have been found in Ontario. They are the largest of the mites and most familiar to ordinary people. The body is covered by a tough leathery skin, which in the female when filled with eggs is shown to be quite elastic by its great distension. They are usually known as ticks and are frequently parasitic upon birds, reptiles, turtles and mammals. Their chief importance is that they are transmitters of disease of man and domestic animals.

Ixodes Marxi, Banks. On Red Squirrel. T. D. J., Guelph.

Ixodes Cooki, Pack. On Groundhog. T. D. J., Guelph.

Boophilus bovis, Riley. On imported cattle. T. D. J., Guelph.

Dermacentor variabilis, Say. Dog tick. T. D. J., Guelph.

Dermacentor albipictus, Pack. Taken from moose. T. D. J., Northern Ont.

Family Gamasoidæ.

Over thirty species are included in the Ontario fauna. Their habitat is of the most varied character of all the Acarids, some parasitic, some predaceous, some vegetarians, and some scavengers. The anatomy of this family is also very much varied. Some have a hard cariaceous integument, others again are quite soft bodied. Their legs are short and usually flat and broad.

Gamasus attenuipes, Banks. Feeding on turnip in Ontario Agricultural College root cellar. T. D. J., Guelph.

Gamasus posticatus, Banks. Under decaying maple leaves in College wood lot. T. D. J., Guelph.

Gamasus sp. Abundant in Ontario Agricultural College herbarium on pressed specimens of Pear-leaf Blister-mite. T. D. J., Guelph.

Gamasus sp. On decaying squash in Ontario Agricultural College garden. T. D. J., Guelph.

Gamasus sp. Under decaying tree in Ontario Agricultural College wood lot. T. D. J., Guelph.

Gamasus sp. Abundant on fruiting bodies of Brown Rot of Cherry (Sclerotinia fructigena). T. D. J., Grimsby, Ont.

Gamasus sp. Under decaying hard maple leaves in Ontario Agricultural College wood lot. T. D. J., Guelph.

Gamasus sp. In gall of Eriophyes on Aspen. T. D. J., Guelph.

Gamasus sp. In horse manure at Ontario Agricultural College. T. D. J., Guelph.

Gamasus sp. On sugar beet in Ontario Agricultural College root cellar. T. D. J., Guelph.

Gemasus sp. Common or Red Squirrel, Ontario Agricultural College. T. D. J., Guelph.

Gamasus sp. Under New York Plum Lecanium on Elm, Ontario Agricultural College. T. D. J., Guelph.

Gamasus sp. In Pine cone. T. D. J., Guelph.

Gamasus sp. Abundant on body of Leopard Frog. T. D. J., Guelph.

Gamasus sp. On stored celery in College cellar. T. D. J., Guelph.

Lælaps pedalis, Banks. On Chipmunk, Ontario Agricultural College. T. D. J., Guelph.

Lælaps multispinosus, Banks. Very abundant on Muskrat, Ontario Agricultural College. T. D. J., Guelph.

Liponyssus Canadensis, Banks. On English sparrow; Meadow Lark; Kingbird; Wood Pewee; White Bellied Nuthatch; Red-eyed Vireo. T. D. J., Guelph.

Lælaps longisita, Banks. Carrion beetle, Ontario Agricultural College. T. D. J., Guelph.

Lælaps propheticus, Banks. Groundhog, Ontario Agricultural College. T. D. J., Guelph.

Sejus macrophilus, Banks. Predaceous; found in gall of genus Eriophyes of Large-toothed Aspen. T. D. J., Guelph.

Dermanyssus gallinae, Redi. Abundant on domestic fowl. Guelph and all through the province. T. D. J., Guelph.

Dermanyssus avium (Fig. 26). Domesticated caged birds. T. D. J., Guelph.

Cœlænopsis latus. Attached to beetle (Passalus cornutus). T. D. J., Guelph.

Liponyssus sp. On Star-nosed Mole. T. D. J., Guelph.

Caelaenopsis pedalis, Banks. Attached to larvæ of Spotted Pelidnota. T. D. J., Guelph.

Uropoda sp. On mangel seed in Experimental basement. T. D. J., Guelph.

Uropoda sp. On leaves of Rananculus acris. T. D. J., Guelph.

Uropoda sp. On Rough Osmoderma; Long-horned Borer; Skin Beetle; Horned passalus; Tumble Bug; Tenebrio. T. D. J., Guelph.

Macrocheles sp. On Horned passalus; Carrion beetle; Large Silpha. T. D. J., Guelph.

Lælaps sp. On Mangel in Ontario Agricultural College root cellar. T. D. J., Guelph.

Liponyssus sp. Attacking dipterous larva feeding on samara of Silver Maple. T. D. J., Ontario Agricultural College, Guelph.

Lælaps sp. On White-bellied Nuthatch. T. D. J., O.A.C., Guelph.

Dermanyssus sp. Abundant on Screech Owl. T. D. J., Guelph.

Family Oribatidæ.

This family is also well represented in our fauna, containing about twenty-four species. They are often called Beetle mites on account of their horny-like integument which in appearance is like the elytra of the Coleoptera. The food of the Oribatidæ is mostly of a vegetable nature, but some species are found on decaying matter and others again on the eggs of scale insects. Their habitat varies very considerably. Some are found under the bark of trees, others on stacked roots, in cavities of stones, on gall tissue, under boards, on decaying leaves, in moss

and various other places. They can easily be recognized by a bristle arising from a small indentation on the posterior corners of the cephalothorax, and abdomen is well marked. The mouth parts are obscure and the palpi very small. An interesting thing about this family is the manner in which some of the nymphs collect and carry moulted skins, dirt, moss, etc., on their backs. The shapes and appendages of this family are strikingly peculiar in many species.

Galumna emarginata, Banks. In cavities in stone. T. D. J., Guelph.

Galumna moesta, Banks. Cavities in stone. On mangels in root cellar, O.A.C. Turnip in root cellar, O.A.C. T. D. J., Guelph.

Nothrus excisus Banks. Under bark of Austria Pine and Norway Spruce T. D. J., O.A.C., Guelph.

Oribatella pallida, Banks. Under bark of Hard Maple, Norway Spruce, Apple, Crab Apple. T. D. J., Guelph.

Hoploderma granulata, Banks. Harrington, Ottawa.

Oribatella formosa, Banks. Under bark of Catalpa, Norway Spruce, Lombardy Poplar, Mountain Ash. T. D. J., Guelph.

Eremaeus pilosus, Banks. Under bark of Catalpa, Buckthorn, Balsam, Cut-leaved Alder, Austria Pine, Mountain Ash. T. D. J., Guelph.

Galumna affinis, Banks. Under board on College campus. T. D. J., Guelph.

Galumna depressa, Banks. On turnip and mangel, in O.A.C. root cellar. T. D. J., Guelph.

Oribata depressa, Banks. On mangel in O.A.C. root cellar. T. D. J., Guelph.

Galumna hirsuta, Banks. Under bark of walnut. T. D. J., Guelph.

Galumna sp. Under Lecanium scale. T. D. J., Guelph.

Oribata sp. In cavities in stone. T. D. J., Guelph.

Nothrus sp. Under bark of Soft Maple. T. D. J., Guelph.

Oribata sp. On large fungus gall of grape. T. D. J., Niagara Falls.

Pelops terminalis. Under bark of Ironwood. T. D. J., Guelph.

Notaspis Burrowski, Nuch. Western Ontario. T. D. J.

Notaspis Canadensis, Banks. W. H. Harrington, Ottawa.

Galumna sylvicola. Among fallen leaves in the forest. T. D. J., Guelph.

Liacarus panulus. From moss on a stump. T. D. J., Guelph.

Oribata Canadensis. Under bark of Ironwood. T. D. J., Guelph.

Oribata perolota. In corn stubble. T. D. J., Guelph.

Oribata neosota. From decayed leaves. T. D. J., Guelph.

Cymberemaeus parvula. Under bark of Ironwood. T. D. J., Guelph.

FAMILY TYROGLYPHIDÆ.

We have found ten species in our fauna. They are great destroyers of property, for, although very minute in size, their enormous numbers make up for their minuteness. The list of species tabulated below will give some idea of the varied habits and habitat of this family. The hypopel stage is a resting one, and at this period in their life history they often attach themselves to other animals, but as the mites do no feeding at this time they cannot be called true parasites. In this stage their chief object is to migrate to new feeding grounds. They are usually pale coloured or slightly tinted with pink, with soft bodies and prominent cheylate mandibles. There are no eyes and no special breathing organs.

Tyroglyphus longior, Germans. In all parts of houses. On cheese in cheese factories, barley seed, whole wheat, turnip and mangel in O.A.C. root cellar; bulb of Gladiolus; under Oyster-shell scale. T. D. J., Guelph.

Tyroglyphus siro, Linnaeus. (Fig. 27.) On cheese in cheese factories in various parts of the Province. Smoked hams. T. D. J.

Tyroglyphus Americanus, Banks. In test tube of Bacteriological laboratory. In jar of raspberry jam. T. D. J., Guelph.

Rhizoglyphus hyacinthi, Bos. Bulb of Gladiolus, common Daffodil. T. D. J., Guelph.

Rhizoglyphus rhizoglyphus, Banks. On hay, O.A.C. barn; decaying potatoes and parsnips, decaying heart of celery. T. D. J., Guelph.

Rhizoglyphus phylloxeræ, Riley. (Fig. 28.) On turnip in root cellar, Guelph; on decaying heart of celery, Guelph; on roots of grape, London. T. D. J., Guelph.

Carpoglyphus passularum, Hr. On raw sugar from store in Guelph; on smoked ham in pork packing house. T. D. J., Guelph.

Histiostoma muscarum. Attached to housefly. T. D. J., Guelph.

Histiostoma valida, Banks. In horse manure, Guelph. T. D. J., Guelph.

Aleurobius farinae. Fairly common in flour in flour mills. T. D. J., Guelph.

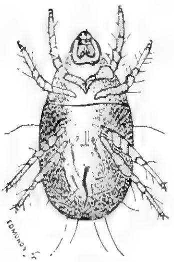

FIG. 27. Tyroglyphus siro—Cheese mite.

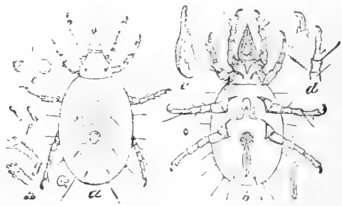

FIG. 28. Rhizoglyphus phylloxeræ.

FAMILY CANESTRINIDÆ.

Only one species so far found in Ontario. It, however, is of much economic importance, as it is predaceous upon the San José Scale. They are small, short-legged mites, closely related to the Sarcoptidæ and also apparently to the Tyroglyphidæ.

Hemisarcoptes malus, Sch. San José Scale, St. Catharines. T. D. J.

FAMILY ANALGESIDÆ.

Forty-three species have been taken in this Province. They inhabit the feathers of birds and apparently do little or no injury to the host. They are extremely small and found in great abundance on the feathers of the wings and other parts of the bird. W. R. Thompson, B.S.A., of the Gypsy Moth Laboratory of Boston, has made a special study of the anatomy and characteristics of this family in Ontario, using the collection of the writer. In this connection I wish to emphasize the patient and painstaking work of Mr. Thompson on this family, while a pupil of the Zoological Department of this College. A full list of these species will be published in the annual report of this Society for 1910.

FAMILY LISTROPHORIDAE.

These are closely related to the bird mites and live upon mammals. Our species was found on the muskrat. They also are small, soft-bodied mites, with short legs terminating in a sucker. Similar to the bird mites they feed upon the hairs of the small mammals.

Listrophorus validus, Banks. Taken from muskrat. T. D. J., Guelph.

FAMILY SARCOPTIDAE.

These are the itch mites of man and domestic animals, birds, etc. They, in some cases, burrow within the skin and thereby produce intense itching, and in many cases a diseased condition of the host, commonly known as scabies or mange. The mites are very small, white and semi-globular in shape. Several species of this family have been found in Ontario.

Sarcoptes scabies, Itch mite. (Figs. 29 and 30.) Host, horses. Ontario, T. D. J., Guelph.

FIG. 29. Male Itch Mite.

FIG. 30. Tunnel of Female Itch Mite beneath the skin—adult at left end, eggs throughout the tunnel.

Chorioptes symbiotes, var. equi, Verheyen. On legs of horses. T. D. J., Guelph.

Chorioptes symbiotes, var. *bovis.* On cattle. T. D. J., Guelph.

Psoroptes communis, Furst. On sheep. Manitoulin Island. T. D. J.

FAMILY ERIOPHYIDAE.

This is a family of microscopic mites, which are quite curious and unusual in structure. They have only two pairs of legs and the abdomen is long and striated. These striations, which differ in the different species and differ in number on the dorsal and ventral surfaces, are of considerable importance in the classification. The galls produced vary in form, but are always open or provided with an opening through which the mites pass in and out. They are generally lined with minute hairs (trichomes), which may be simple or branched. The different types of Eriophyid galls are shown in figures 31 to 39. Sixty-six species occur in Ontario.

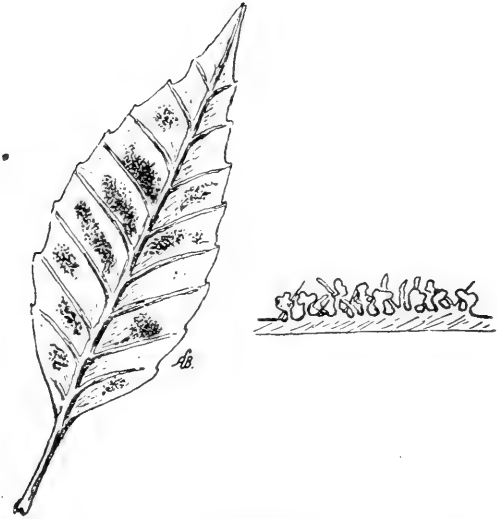

FIG. 31. Erineum on leaf of beech ; natural size and highly magnified.

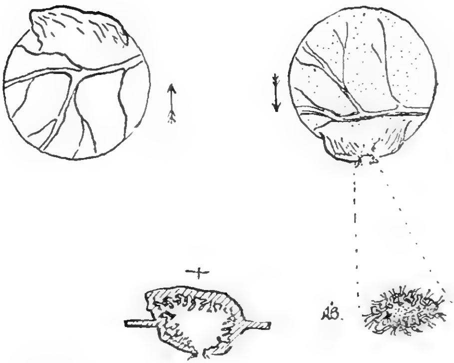

FIG. 32. Capsule Gall : Upper and lower surfaces ; interior and opening of capsule, highly magnified.

Host—Alder.

Eriophyes sp. A white, frost-like erineum on under side of leaf in the axils of the veins. Trichomes dense, pellucid. (Fig. 31.) Alnus incana. T. D. J., Guelph.

Eriophyes sp. A small, red or green pubescent pocket gall on leaf. Alder Pocket Gall. (Fig. 34.) Alnus incana. T. D. J., Guelph.

Host—Ash.

Eriophyes fraxini (Garman). Small, irregular, smooth, more or less spherical capsule gall, protruding on both sides of the leaf. Ash Mite Gall. (Fig. 32.) Fraxinus americana. T. D. J., Guelph.

Eriophyes sp. Pinkish-white, elongated capsule galls on the veins of the leaf. Ventrally the galls appear as white, hairy projections following the veins. Ash Vein Gall. T. D. J., Guelph.

Eriophyes sp. A deformation of the terminal buds, their development arrested, producing a mass of small twisted leaf ends. Fraxinus americana. (Fig. 37.) T. D. J., Guelph.

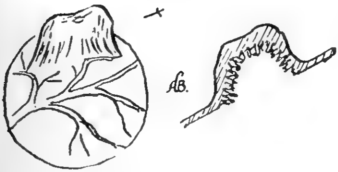

Fig. 33. Dimple Gall and section of interior greatly magnified.

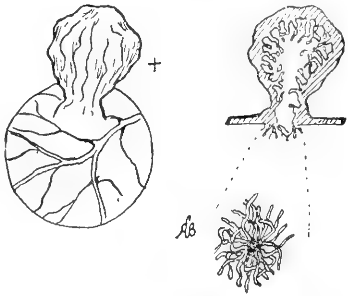

Fig. 34. Pocket Gall: Upper surface of leaf; interior of gall, much magnified.

Eriophyes sp. Leaves dwarfed and distorted in a bundle. Resembles somewhat Cecidomyia solidaginis. Ash Bunch Gall. Fraxinus americana. T. D. J., Guelph.

Eriophyes sp. Small, irregular, more or less spherical capsule gall, protruding on both sides of leaf. Galls hairy. Fraxinus pubescens. T. D. J., Guelph.

Host—Basswood.

Eriophyes abnormis, Garman. Balloon-shaped galls on the upper surface of the leaf. Apex of gall usually serrated. Basswood Balloon Gall. Tilia americana. T. D. J., Guelph.

Eriophyes sp. Irregular, circular, dark reddish-brown spots 4-5 mm. in diameter, having in their centre very characteristic tufts of whitish hairs. Basswood Tufted Gall. Tilia americana. T. D. J., Guelph.

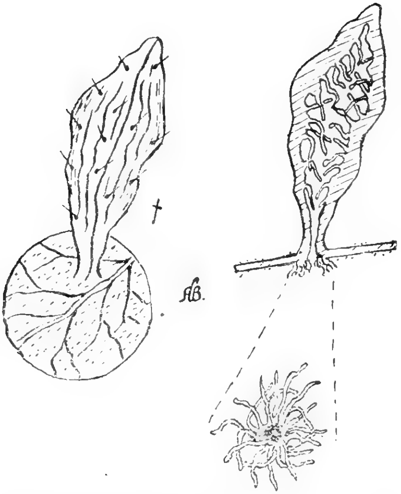

FIG. 35. Pouch Gall on upper surface of leaf; interior of gall, much magnified.

FIG. 36. Leaf-margin Gall.

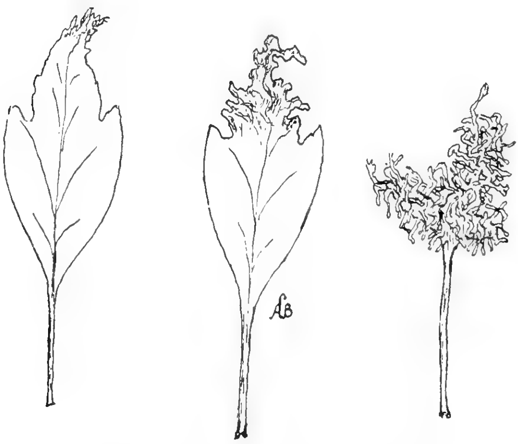

FIG. 37. Leaf-distortion Gall, different stages.

Eriophyes sp. A white erineum or shallow dimple on underside of leaf, much like the Erineum on Acer negundo. Tilia europea. T. D. J., Guelph.

HOST—BEECH.

Eriophyes sp. A frosty, white erineum in large patches on the under side of the leaf. Trichomes spherically capitate. Fagus americanus. T. D. J., Guelph.

HOST—BIRCH.

Eriophyes sp. A bud deformation, crowded and irregular, often in bunches of large size. Birch Bud Gall. (Fig. 38.) Betula lutea. T. D. J., Guelph.

Eriophyes sp. A rosy-pink erineum in large patches on the upper side of the leaf. Betula lenta. T. D. J., Guelph.

FIG. 38. Bud-like Galls.

FIG. 39. Serpentine Gall.

Eriophyes sp. A yellowish-white to brownish erineum forming large patches between the ribs on the under side of the leaf. Betula papyrifera. T. D. J., Guelph.

Eriophyes sp. A transparently white, granular erineum on the surface of the leaves. Betula pumila. T. D. J., Guelph.

Eriophyes sp. A capsule gall, very small, yellow to brown. Paper Birch Capsule Gall. (Fig. 32.) Betula papyrifera. T. D. J., Guelph.

Eriophyes sp. A nodular pocket gall, occurring upon both faces of the leaf; yellowish, or reddish to purplish. Paper Birch Pocket Gall. Betula papyrifera. (Fig. 34.) T. D. J., Guelph.

HOST—BUTTONBUSH.

Eriophyes cephalanthe (Cook). Clusters of small dimples on the upper side of the leaf, 1 to 3 mm. high. Buttonwood Dimple Gall. Cephalanthus occidentalis. T. D. J., Guelph.

HOST—CHESTNUT.

Eriophyes sp. A small, capsule gall on the leaf, more or less spherical and 2-3 mm. in diameter. Chestnut Capsule Gall. Castanea sativa, var. americana. T. D. J., Guelph.

Host—Elm.

Eriophyes ulmi (Garman). Small green to yellowish pocket-galls, more or less spherical, usually on the upper side of the leaves. Elm Pocket Gall. (Fig. 34.) Ulmus americana and U. racemosa. T. D. J., Guelph.

Eriophyes sp. An erineum on the under side of the leaf; white at first, changing to brown. Trichomes simple, tangled. Rock Elm Erineum Gall. Ulmus racemosa. T. D. J., Guelph.

Eriophyes sp. A very large pouch-gall on the leaves, commencing as a cone or deep dimple. (Fig. 35.) Ulmus pubescens. T. D. J., Guelph.

Host—Grape.

Eriophyes sp. A white erineum on the underside of the leaf. Trichomes simple. Wild Grape. T. D. J., Guelph.

Eriophyes sp. Small, semi-circular or nearly circular capsules along the veins, about 2 mm. in diameter, and but slightly elevated on either surface. On upper surface paler than the leaf; below, with a white nipple surrounded by a furrow. Vitis cordifolia. T. D. J., Guelph.

Host—Hawthorn.

Acarus crataegi vermiculus. A fold of the leaf making long, irregular, wavy projections on the upper surface of the leaf. From the midrib to the edge of the leaf in the general direction of the gall. Serpentine Gall. Cratægus sp. T. D. J., Guelph.

Eriophyes sp. Small, round swellings (capsules) protruding very slightly on both sides of the leaf. About .5-1 mm. in diameter. Galls very numerous where they occur—sometimes more than 100 on a single leaf. Speck Gall. Cratægus sp. T. D. J., Guelph.

Eriophyes sp. Very small, monothalmous, conical structures, 1 to 2 mm. high and 1-1.5 mm. wide at the base; formed anywhere on either surface of the leaf and sometimes on the stem of young twigs. Cone Gall. Cratægus sp. T. D. J., Guelph.

Host—Hazel.

Eriophyes sp. This gall is found only along the main veins of the leaf. The part of the leaf around the affected portion of the vein becomes crimped, the crimps all radiating towards the vein as a common centre. Hazel Leaf Crimp Gall. Corylus americana. T. D. J., Guelph.

Eriophyes avellanae. A bud deformation, which attacks bud as soon as it expands, and checks its subsequent development. Hazelnut Bud Gall. Corylus americana. T. D. J., Guelph.

Host—Genus Juglans.

Eriophyes sp. A brown, velvety erineum surrounding the leaf stalks, or on the main veins, causing a swelling or bending of the stalk or vein. Walnut Cushion Gall. Juglans nigra and probably J. cinerea. T. D. J., Guelph.

Eriophyes sp. A green pocket-gall on the upper side (usually) of the leaf. Walnut "Wart" Gall. Juglans nigra and probably J. cinerea. T. D. J., Guelph.

Host—Juneberry.

Eriophyes sp. Small, nearly globular, dark brown, pocket galls, averaging 2 mm. in diameter, singly or in clusters on the upper side of the leaf. Juneberry Ball Gall. Amelanchier rotundifolia. T. D. J., Guelph.

Host—Maple.

Eriophyes sp. A whitish frost-like erineum with scattered spots of rosy-pink, on the upper surface of the leaf, sometimes nearly covering it. Acer rubrum. T. D. J., Guelph.

Eriophyes sp. A pale yellow or white erineum on the under side of the leaf. Trichomes capitate. Acer saccharinum. T. D. J., Guelph.

Phlœcoptes quadripes. A nearly spherical pocket gall on the upper surface of the leaf, varying from light green through red or purple to black. Acer saccharinum. T. D. J., Guelph.

Eriophyes sp. A white or whitish erineum in patches on the under side of the leaf, often limited by the veins. Trichomes capitate. When old, the trichomes assume a brown colour. Acer saccharum. T. D. J., Guelph.

Phlœcoptes aceris. A green, reddish or purplish, slender, pouch-gall projecting from the upper surface of the leaf. Acer saccharum. T. D. J., Guelph.

Eriophyes sp. A white or whitish erineum on the under side of the leaf. Acer nigrum. T. D. J., Guelph.

Eriophyes sp. Irregular wart-like swellings (Dimple) on the upper surface of the leaf. The swellings are green at first and turn gray when mature. The average diameter is about 3 mm. Manitoba Maple Wart Gall. Acer negundo. T. D. J., Guelph.

Eriophyes sp. A white, whitish, or pale yellow erineum on the under side of the leaf, in patches often in the axils of the veins. Trichomes long, tangled and distorted. Acer spicatum. T. D. J., Guelph.

Host—Oak.

Eriophyes querci. An irregular dimple upon the blade of the leaf. From beneath it appears as an irregular cavity, lined with a tangled mass of white vegetable hairs. Oak Dimple Gall. Quercus macrocarpa. T. D. J., Guelph.

Eriophyes sp. A dense mat of brown hairs growing in large patches upon the under side of the leaves. Oak Hair Gall. Quercus sp. T. D. J., Guelph.

Host—Poplar.

Eriophyes sp. Circular, flat or slightly convex, frost-like patches varying from 2-3 mm. in diameter, on the upper side of the leaf. Large-toothed Aspen Frost Gall. Populus grandidentata. T. D. J., Guelph.

Eriophyes sp. Circular depressions dimple always on the lower side of the leaf. On the upper side it appears as a reddish circular elevation. Large-toothed Aspen Convex Gall. Populus grandidentata. T. D. J., Guelph.

Eriophyes sp. Dimple-like galls on the upper side of the leaf of the Aspen. Aspen Dimple Gall. Populus tremuloides. T. D. J., Guelph.

Eriophyes sp. Irregular tubercular masses of closely-packed small reddish-green protuberances on the stem. Unsightly Poplar Gall. Populus tremuloides.

Eriophyes sp. A depression on the lower surface of the leaf, 4-12 mm. in diameter and 2-5 mm. in depth. Under surface of gall is orange-yellow. Populus italica. T. D. J., Guelph.

Eriophyes sp. Margin of leaf distorted and curled. Populus tremuloides. T. D. J., Guelph.

Host—Genus Prunus.

Eriophyes sp. Reddish, slender pouch-galls, somewhat irregular and pubescent, ¾ mm. long and .5-1 mm. in diameter. Pin Cherry Pouch Gall. Prunus pennsylvanica. T. D. J., Guelph.

Eriophyes sp. Green on rosy-red pouch-gall on the upper side of the leaf .5-6 cm. in length. The gall is constricted about half way to the leaf. Black Cherry Pouch Gall. Prunus serrotina. T. D. J., Guelph.

Eriophyes sp. Green or reddish pouch gall on the upper side of the leaf, differing from the Black Cherry Pouch Gall in that the aperture is not funnel-shaped. Choke Cherry Pouch Gall. Prunus virginiana. T. D. J., Guelph.

Eriophyes sp. A very long, slender, pouch-gall, green or whitish on either side of the leaf. Wild Plum Pouch Gall. Prunus americana. T. D. J., Guelph.

Eriophyes phlœocoptes. A tubular growth, encircling base of buds and shoots. Plum Bud Gall. Prunus domestica. T. D. J., Guelph.

Host—Genus Pyrus.

Apple, Crab Apple. Pear and Chokecherry.

Eriophyes sp. Dimple galls, with the concavity on the upper surface of the leaf. Internal surface corrugated. Apple Dimple Gall. Pyrus malus. T. D. J., Guelph.

Eriophyes pyri. Capsule Galls on the upper side of the leaf. Apple and Pear "Leaf-blister" Gall. Pyrus malus, P. coronaria and P. communis. T. D. J., Guelph.

Eriophyes sp. Capsule Galls, very small. When mature, brown in color. Chokecherry Speck Gall. Pyrus arbutifolia. T. D. J., Guelph.

Host—Sumac.

Eriophyes sp. The leaf margin rolled tightly upward and inward on both sides. Sumac Leaf-margin Gall. Rhus typhina. T. D. J., Guelph.

Eriophyes sp. Irregular, rounded, dimple gall, convex on the upper or under side of the leaf. Green to red or purple in color; inside clothed with white trichomes. Poison Ivy Dimple Gall. Rhus radicans. T. D. J., Guelph.

Host—Willow.

Eriophyes sp. A pale green or purple capsule gall, projecting either above or below the leaf, or both; 1½ to 2 mm. in diameter. Salix cordata. T. D. J., Guelph.

Eriophyes sp. Small, irregular, serrate and roughened pocket-galls or semi-capsules, green or red, strongly pilose above and thickly pubescent beneath. Usually on the upper side of the leaf. Salix discolor. T. D. J., Guelph.

Eriophyes sp. Small, crimson pocket-galls or semi-capsules on the upper side of the leaf. 1½ to 2½ mm. in diameter. Salix amygdaloides. T. D. J., Guelph.

Eriophyes sp. A small capsule gall, irregularly hemispherical, greenish yellow, with a projecting aperture usually on the lower surface of the leaf, 1 to 2½ mm. in diameter. Salix nigra. T. D. J., Guelph.

Eriophyes sp. Small, irregular, serrate capsule gall, green or red, usually on the upper side of the leaf; beneath sometimes impressed, more often projecting. 1 to 2 mm. in diameter. Salix bebbiana. T. D. J., Guelph

Eriophyes sp. Small, irregular, serrate capsule gall, projecting on both sides of the leaf, 1 to 2 mm. in diameter. Salix petiolaris. T. D. J., Guelph.

Eriophyes sp. A bud deformation of the flower catkins and leaf buds or parts of leaves, producing a large, irregular, crumpled mass. Salix nigra. T. D. J., Guelph.

Eriophyes sp. Rosette-like structures on the leaves and stems. Unsightly Willow Gall. Salix sp. T. D. J., Guelph.

Family Demodecidæ.

This again is a small family, only two species being found in the Province, one parasitic upon man and the other on swine. They are small and worm-like and resemble the gall mites.

Demodex folliculorum, Simon. Parasitic on man. T. D. J., Guelph.
Demodex phylloides, Croker. On hog. T. D. J., Guelph.

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Brodie, W. Mites on Grasses in the Counties around Toronto. Report of Entomologist and Botanist, Central Experimental Farm, Ottawa, p. 10, 1887.

Chadwick, Geo. A Catalogue of the Phytoptid Galls of North America. 23rd Report of the State Entomologist on Injurious and Other Insects of the State of New York, Oct. 15th, 1909.

Dearness, John. A parasite of the San José Scale. Thirty-first Annual Report of the Entomological Society of Ontario, 1900.

Fletcher, James. The Locust Mite. Report of Entomologist and Botanist, Central Experimental Farm, Ottawa, p. 240, 1896.

Jarvis, Tennyson D. The Phlox Mite, Tetranychus bimaculatus. Thirty-sixth Annual Report of the Entomological Society of Ontario, 1905. Mites affecting Farm Homesteads. The Canadian Entomologist, Vol. XXXVIII., No. 7, 1906. The Locust Mite. The Canadian Entomologist, Vol. XXXVIII., No. 10, 1906. Apparatus for trapping small Arthropods. Thirty-ninth Annual Report of the Entomological Society of Ontario, 1908. Gall Insects of Ontario. Thirty-seventh, thirty-eight and thirty-ninth Annual Reports of the Entomological Society of Ontario.

Saunders, William. Destroying eggs of Clisiocampa sylvatica and C. Americana on Nursery Stock in Ontario. Ninth Annual Report of the Entomological Society of Ontario.

THE ENTOMOLOGICAL RECORD, 1909.

By Arthur Gibson, Ottawa.

The weather conditions of 1909, on the whole, in Canada, were particularly well suited for the growth of vegetation of all kinds. In eastern Ontario, comparatively speaking, there were few really hot days, and these not until about the middle of August. Injurious insects were not complained of to such an extent as they were in 1908. Many collectors have commented on the scarcity of insects, even of many of the commoner forms. As is always the case, however, desirable species have been collected by those who have worked assiduously throughout the season. In Manitoba, Mr. Norman Criddle reported that the season was a most peculiar one, the evenings being particularly bright, for which reason it was almost impossible to attract any moths to lights. In the early part of the season, too, there was an exceptional outbreak of plant lice of all kinds, and it was noticed that night-flying moths frequented trees, mostly Manitoba maples and oaks, which were infested by the aphides, to feed upon their honey dew. The past season was certainly a most remarkable one for plant lice all over Canada.

During 1909 a good deal of material, collected in previous years, has been worked up by specialists, and notes on some of these are included in this year's Record. Unfortunately, a number of our Canadian collectors have not been as active in 1909 as they were in other years. Undoubtedly the great loss sustained by entomologists generally throughout Canada in the death of Dr. James Fletcher, has had some effect on systematic work. We should, however, now even strive all the more to continue the work he so ardently encouraged.

Since the appearance of the Entomological Record for 1908, the writer has received letters from many collectors, all of whom expressed the hope that the Record would be continued from year to year. He begs to thank his correspondents for their continued interest and help.

During 1909 few important expeditions have been made in Canada, as far as the writer knows, for the purpose of collecting and studying insects. Mr. J. B. Wallis, of Winnipeg, Man., spent most of the summer in the Okanagan Valley of British Columbia, and while there collected several thousand specimens which will be gradually worked up. Mr. C. H. Young, of the Geological Survey, Ottawa, while at Ucluelet, B.C., from May to August, collected a good many insects of interest. His work there, however, with Prof. John Macoun, of the same institution, was chiefly connected with the collection and preservation of star fish, crabs and other salt water objects. Mr. Geo. A. Moore, of Montreal, collected hemiptera almost exclusively at North Hatley, Que., in July, and secured much interesting material. The writer spent the whole of August in New Brunswick and Prince Edward Island and brought back collections in all orders.

In 1907 Messrs. Ernest Thompson Seton and E. A. Preble brought back with them from the Great Slave region a small collection of lepidoptera, among which were some interesting species. Mr. Wm. Beutenmuller, of the American Museum of Natural History, New York, has very kindly sent me a list of the species, and mention is made of several of them in this Record.

As in previous years, Canadian students have again to acknowledge the great help which they have received during the year from specialists in the United States and elsewhere. Those who have specially helped, in 1909, are: Dr. L. O. Howard, with his assistants, at Washington, D.C.; Dr. J. B. Smith, of New Brunswick, N.J.; Sir George Hampson, of the British Museum; Prof. H. F.

Wickham, of Iowa City, Iowa; Mr. W. D. Kearfott, of Montclair, N.J.; Mr. E. P. Van Duzee, of Buffalo, N.Y.; Mr. Wm. Beutenmuller, of New York, N.Y.; Dr. Henry Skinner, of Philadelphia, Pa.; Dr. E. M. Walker, of Toronto, Ont.; Col. Thos. L. Casey, of Washington, D.C.; Mr. Charles Leibeck, of Philadelphia, Pa., and Rev. G. W. Taylor, of Departure Bay, B.C.

Literature.

Among the publications which have been received during the year, and which are of interest to Canadian students, mention may be made of the following:—

Back, Ernest A. The Robber-flies of America, North of Mexico, belonging to the subfamilies, Leptogastrinæ and Dasypogoninæ. Trans. Amer. Ent. Soc., Numbers 2 and 3, April-September, 1909. pp. 137-400. In this splendid paper 194 species, and 36 genera are described; 20 species and 1 genus are new. Eleven plates, illustrating a number of the species, appear at the end of the paper. Only 12 species are recorded from Canada. Many others have doubtless been taken in the Dominion, but these were not available for study by the author. The paper is a welcome one and will be of much value to dipterists.

Banks, Nathan. Directions for Collecting and Preserving Insects. Washington; Smithsonian Institution, Bulletin No. 67. This valuable bulletin was received on Oct. 14, 1909. It takes the place of the work prepared in 1892, under the direction of the late Dr. C. V. Riley. Many new features occur in this bulletin, and a large number of notes are included which have been furnished by specialists in the different Orders. 188 figures in the text appear, as against 139 in Riley's publication. The Bulletin will be most useful as a means of reference.

Beutenmuller, William. The Species of Holcaspis and their Galls (issued 17th Feb., 1909); The Species of Amphibolips and their Galls, (issued March 9, 1909); The North American Species of Diastrophus and their Galls, (issued March 19, 1909): American Museum of Natural History, New York. These papers on gall insects are most useful. The illustrations accompanying each are beautifully drawn, and with the descriptions of the galls and the makers, afford an easy means of identification. We hope to see more of these articles by this well-known author. Many of the species included in the above papers occur in Canada.

Blaisdell, Frank E., Sr. A Monographic Revision of the Coleoptera belonging to the Tenebrionid Tribe Eleodiini, inhabiting the United States, Lower California and adjacent Islands. United States National Museum, Bulletin 63, Washington, issued June 24, 1909. This important monograph of 524 pp. and 13 plates, represents an enormous amount of work for which coleopterists generally will be very grateful. 124 species and varieties are treated of, each at considerable length. It is to be hoped that this bulletin will be freely used by Canadian coleopterists, so that we may soon know more about the beetles of this tribe occurring in the Dominion.

Hampson, Sir George F. (*Bart*). Catalogue of the Lepidoptera Phalænæ in the British Museum; Vol. VII., pp. 709, plates cviii. to cxxii., received Feb. 8th, 1909; Vol. VIII., pp. 583, plates cxxiii. to cxxxvi., received Sept. 1st, 1909. These two volumes which appeared during the year are of great interest to students of the lepidoptera. Vol. VII. is the first part of "the classification of the very large sub-family *Acronyctinæ*, which comprises some 3,000 species belonging to over 300 genera. .... The sub-family is characterised by the trifid neuration of the hind wing combined with spineless tibiæ and smooth eyes not surrounded by bristle-like hair, and it is the least specialised of the sub-

families of the *Noctuidæ Trifinæ.*" Vol. VIII. is the second part of the *Acronyctinæ;* 104 genera are treated of, comprising 720 species. In Vol. VII., 843 species belonging to 96 genera are dealt with. The third and final part of the subfamily is prepared and it is expected will be issued very soon. The beautiful coloured plates which accompany each volume of the Catalogue, are of immense service to students. Those which refer to Vols. VII. and VIII., are of the same degree of excellence. Many of the species figured occur in Canada, and are at once recognized. We are glad to see the names of several Canadian collectors in the text. all of whom have sent material for the collection of the British Museum. Sir George Hampson is very grateful for noctuids from Canada, and all who can should assist him as far as possible in his valuable work.

HOPKINS, A. D. The Genus Dendroctonus. (Contributions toward a monograph of the Scolytid beetles). United States Department of Agriculture, Bureau of Entomology; Technical Series No. 17, Part 1, issued June 30, 1909. The results of Dr. Hopkins' studies in this important genus will be of much use to coleopterists generally, and of particular interest to the economic entomologist. This first part of the bulletin is one of the best of the many valuable publications of the U. S. Bureau of Entomology. In the introductory chapter it is stated that, "It is the purpose of this paper to revise and bring up to date the available information on the described species, to describe those that appear to be new to science, and to record the results of original investigations relating to the more technical details that can not well be included in the paper which is to follow as a part of a bulletin in the regular series and which will give full information on the bionomic features." Twenty-four species are treated of, seven of which are new to science.

SMITH, JOHN B. Our Insect Friends and Enemies—The Relation of Insects to man, to other animals, to one another, and to plants, with a chapter on the War Against Insects. Philadelphia and London, J. B. Lippincott Company, 1909. This splendid work of 314 pp., by the above recognized authority, is a very welcome addition to the literature of Entomology. Dr. Smith has divided the book into 12 chapters, viz.: (I) Insects in their Relation to the Animal Kingdom; (II.) Insects in their Relation to Plants as Benefactors; (III.) Insects in their Relation to Plants as Destroyers; (IV.) Insects in their Relation to each other; (V.) Insects in Relation to the Animals that feed on them; (VI.) Insects in their Relation to Weather and Diseases that affect them; (VII.) Insects in their Relation to other Animals; (VIII.) Insects in their Relation to Man as Benefactors; (IX.) Insects in their Relation to Man as Carriers of Diseases; (X.) Insects in their Relation to the Household; (XI.) Insects in their Relation to the Farmer and Fruit Grower; (XII.) The War on Insects.

The book is full of information and will doubtless have a very wide sale. It is illustrated by many figures in the text, and at the beginning there is a full-paged coloured plate of some of the commoner insects which are troublesome in houses. The work is well printed, and we congratulate the author on this latest of his many publications.

SNODGRASS, R. E. The Thorax of Insects and the Articulation of the Wings: Proc. U. S. Nat. Museum, Vol. XXXVI., pp. 511-595; separates published June 18, 1909. This paper will be found of much interest to entomologists generally. It represents a good deal of careful work and will no doubt be of much use to students. The author states that the paper is an attempt to show the unity of thoracic structure that prevails throughout all the orders of insects. Thirty plates appear at the end of the paper and there are, besides, some figures in the text.

SWAINE, J. M. Catalogue of the Described Scolytidæ of America, North of Mexico. Appendix B., 24th Report of the State Entomologist on Injurious and other Insects of the State of New York, 1908, received Sept. 30, 1909. This catalogue covering 84 pages practically includes, the author states, all the literature published on the North American species of the family. 191 species are listed. It will be of much value to entomologists, especially those engaged in economic work. The author is to be congratulated on the result of his labour, and students generally will be grateful to Dr. Felt for publishing the catalogue.

The following is a list of the names and addresses of collectors heard from during 1909:—

Anderson, E. M., Provincial Museum, Victoria, B.C.
Baird, Thomas, High River, Alta.
Baldwin, J. W., 74 Besserer Street, Ottawa.
Bethune, Rev. Prof., O. A. C., Guelph.
Boulton, A. R. M., care King Brothers, Quebec, Que.
Bush, A. H., 1105 Ninth Ave., Vancouver, B.C.
Chagnon, Gus., Box 186, Montreal.
Cockle, J. W., Kalso, B.C.
Criddle, Norman, Treesbank, Man.
Dawson, Horace, Hymers, Ont.
Day, G. O., Duncans, B.C.
Dent, W. A., Sarnia, Ont.
Dod, F. H., Wolley, Millarville, Alta.
Evans, J. D., Trenton, Ont.
Fyles, Rev. T. W., Hull, Que.
Gibson, Arthur, Experimental Farm, Ottawa.
Groh, H., Experimental Farm, Ottawa.
Hahn, Paul, 433 Indian Road, Toronto.
Halkett, A., Fisheries Museum, Ottawa.
Hanham, A. W., Duncans, B.C.
Harms, J. F., Treesbank, Man.
Harrington, W. H., P.O. Department, Ottawa.
Harvey, R. V., Victoria, B.C.
Heath, E. F., Cartwright, Man.
Hudson, A. F., Millarville, Alta.
Jarvis, T. D., O. A. C., Guelph.
Keele, Jos., Geological Survey, Ottawa.
Keen, Rev. J. H., Metlakatla, B.C.
Letourneau, Jos. A., Experimental Farm, Ottawa
Lyman, H. H., 74 McTavish Street, Montreal.
Marmont, L. E., 2553 Second Ave. West, Vancouver, B.C.
McIntosh, W., St. John, N.B.
Metcalfe, W., 288 Bank Street, Ottawa.
Moore, W. H., Scotch Lake, N.B.
Moore, G. A., 850 St. Hubert Street, Montreal.
Morris, Frank, Port Hope, Ont.
Nelles, Douglas H., Dept. Interior, Ottawa.
Perrin, Jos., McNab's Island, Halifax, N.S.
Rowland, Alton, Windsor Mills, Que.

Russell, John, Bon Accord, New Westminster, B.C.
Sanson, N. B., Banff, Alta.
Saunders, Henry, 21 Harbord Street, Toronto.
Sherman, R. S., 2285 Sixth Avenue, Vancouver, B.C.
Simpson, W., Dominion Observatory, Ottawa.
Southee, G. R., Sherbrooke, Que.
Swaine, J. M., Macdonald College, Que.
Taylor, Rev. G. W., Departure Bay, B.C.
Tipping, E. Dalton, Bluff Centre, Alta.
Venables, E. P., Vernon, B.C.
Walker, Dr. E. M., Harbord St., Toronto.
Wallis, J. B., Machray School, Winnipeg, Man.
Willing, T. N., Regina, Sask.
Wilmot, E. S., Vernon, B.C.
Wilson, W. J., Geological Survey, Ottawa.
Winn, A. F., 32 Springfield Ave., Westmount, Que.
Young, C. H., Geological Survey, Ottawa.
Zavitz, E. J., O. A. C., Quelph, Ont.

NOTES OF CAPTURES.

Lepidoptera.

(Arranged according to Dyar's List of North American Lepidoptera, U.S. N.M. Bull. No. 52).

(Dyar's number).

5. *Iphidicles ajax* L. Pt. Pelee, Ont., 1 specimen, Sept. 6, (P. T. Taverner). On August 18, 1904, Dr. W. W. Newcomb, of Detroit, Mich., found this butterfly common at a patch of Papaw near Windsor, Ont. 15 eggs, 64 larvæ and chrysalids were found and 7 imagoes seen.

34. *Pintia* sisymbri Bdv. Fort Smith, Mackenzie, June 15, (Thompson and Preble).

63. *Eurymus hecla* Lefbr. On Island, north shore of Great Slave Lake, July 23, Long. 110°, (Thompson and Preble).

73. *Eurymus pelidne* Bdv. East end of Clinton-Golden Lake, Aug. 10; Artillery Lake, Aug. 13, (Thompson and Preble).

104. *Argynnis cornelia* Edw. Golden, B.C., June 24, (Wallis).

139. *Brenthis polaris* Bdv. On Island, near north shore of Great Slave Lake, July 23, (Thompson and Preble).

248. *Chlorippe clyton.* B. & LeC. Pt. Pelee, Ont., common, Aug. 14, 6 specimens taken, (P. A. Taverner).

289. *Œneis macounii* Edw. On Island, north shore of Great Slave Lake, July 23, (Thompson and Preble). A new locality for this interesting butterfly.

290. *Œneis nevadensis* Felder. Vernon, B.C., one specimen in the valley; the first I have seen, (Venables).

295f. *Œneis taygete* Hbn. East end of Clinton-Golden Lake, Aug. 10; on Island, north shore of Great Slave Lake, July 23, (Thompson and Preble).

362. *Mitoura damon* Cramer. Pt. Pelee, Ont., May 31, (Dr. W. W. Newcomb). Writing of this species, Dr. Newcomb says: "In walking along and dis-

turbing low vegetation, mostly *Juniperus communis*, I discovered this handsome little butterfly. In about an hour in the middle of the day I secured 12 specimens, and my friend, Taverner, also caught several. One male was very dark above with just a suggestion of the brownish-yellow scales on the disk of the four wings and a trace of the same above and between the tails. I should class this as Brehme's *patersonia*, or at least as coming very close to it."

469. *Pamphila palæmon* Pallas. Sherbrooke, Que., July 1, (Southee).

644. *Hesperia centaureæ* Ramb. Fort Smith, Mackenzie, July 2, (Thompson and Preble).

683. *Ampelophaga versicolor* Harris. Britannia, near Ottawa, July 26, (Baldwin).

699. *Phlegethontius convolvuli* L., a *cingulata* Fab. Trenton, Ont. (Evans).

702. *Sphinx perelegans* Hy. Edw. Wellington, B.C., June 6, 7, (Taylor); Peachland, July 6, (Wallis).

704. *Sphinx luscitiosa* Clemens. Britannia, near Ottawa, July 9, 22; 2 specimens, (Baldwin).

728. *Marumba modesta* Harr. Artillery Lake, Aug. 13. (Thompson and Preble). A very northern record.

778. *Basilona imperialis* Dru. Go-Home-Bay, Ont., one specimen found in water, July 12, (Williams); Trenton, Ont., 1 sp. June 27, (Evans).

869. *Neoarctia yarrowi* Stretch. One female at rest on a rock in the hot sun on Mt. Huber, B.C., Aug. 9, about 8,000 feet above sea level, (Lyman).

960. *Panthea acronyctoides* Walk. Montmorency Falls, Que., June 23, (Lyman).

981. *Apatela cretata* Smith. Millarville, Alta., June 22 to July 16th, about 20 specimens at treacle, (Dod).

1,008. *Apatela funeralis* Grt. McNab's Island, Halifax, N.S., emerged June 20, (Perrin).

1,029. *Apatela sperata* Grt. Regina, Sask., June 15, (Willing).

1,042. *Apatela lanceolaria* Grt. Larva found on cherry at Saskatoon, Sask.; green with yellowish bristles from tubercles, one and three-quarter inches long; fed it on some rose leaves; pupated Aug. 1, moth emerged April 28, (Willing).

1,050. *Merolonche lupini* Grt. Duncans, B.C., one at light, (Hanham).

1,053. *Harrisimemna trisignata* Walk. Windsor Mills, Que. (Rowland); Hull, Que., full grown larva on ash, Aug. 28, (Groh).

1,075. *Baileya doubledayi* Gn. Windsor Mills, Que., (Rowland).

1,141. *Oligia grata* Hbn. Trenton, Ont., Oct. 18, (Evans).

1,147. *Hillia discinigra* Walk. Cartwright, Man., Aug. 24, (Heath).

1,211. *Hadena stipata* Morr. McNab's Island, Halifax, N.S., Sept. 13, (Perrin).

1,220. *Hadena vultuosa* Grt. Millarville, Alta., June 28, (Dod).

1,223. *Hadena morna* Strk. High River, Alta., (Baird).

Hadena commoda Walk, = *alberta* Smith. Millarville, Alta., June 22 to July 24, about 20 specimens at treacle. I have seen the type of *commoda* in the British Museum, and agree with Sir George Hampson in referring Prof. Smith's species here, (Dod).

1281. *Hyppa brunneicrista* Sm. Millarville, Alta., June 21 to 30, about 20 specimens at treacle, being more than I had ever seen altogether; mostly worn; I saw fewer *xylinoides*, (Dod).

1,286. *Momophana comstocki* Grt. McNab's Island, Halifax, N.S., June 11, (Perrin).

Oncocnemis poliochroa Hamp. Penticton, B.C., Aug. 10; Peachland, B.C., Aug. 7, (Wallis). A record for B.C., (Dod).

1,401. *Rhynchagrotis vittifrons* Grt. Penticton, B.C. (L. A. De Wolfe).

1,409. *Rhynchagrotis crenulata* Sm. Penticton, B.C. (L. A. De Wolfe).

1,413. *Adelphagrotis indeterminata* Walk. Duncans, B.C., August, at sugar, rare, (Hanham).

1,480. *Noctua conchis* Grt. Regina, Sask., July 11, (Willing).

Noctua patefacta Sm. Millarville, Alta., July 8 to Aug. 9, a few at treacle. The type of *juncta* Grt., which Sir George Hampson treats as distinct, came from Nova Scotia, and has a pale head and thorax, with dark, pale tipped collar. *Patefacta* has these parts dark, and nearly unicolorous. The variation, however, is towards *juncta*, and I doubt their distinctness, (Dod).

1,507. *Noctua flavotincta* Sm. Ucluelet, B.C., (Young).

1,514. *Noctua lubricans* Gn. Mt. St. Hilaire, Que., June 30, (Chagnon).

Noctua dislocata Sm. Millarville, Alta., July 10 to 24, a few at treacle, (Dod).

1,530. *Rhizagrotis albicosta* Sm. The specimen recorded from High River, in 1906, is the red costal form of *flavicollis* Sm., recorded in the next line from the same place. Specimens named *albicosta*, by Prof. Smith, in the British Museum, are an entirely dissimilar species, which I have not yet seen from Canada, (Dod).

1,682. *Paragrotis fuscigera* Grt. The specimen so recorded in the Record for 1908, from Olds, Alta., is the species listed as *pleuritica*, from Calgary. Both names are wrong for the species, which Sir George Hampson will shortly describe as new, (Dod).

1,724. *Paragrotis obeliscoides* Gn. Trenton, Ont., 2 sp., July 5, 1 sp. July 10, (Evans).

Mamestra artesta Sm. Winnipeg, Man., June 26, (Wallis).

1,782. *Mamestra lustralis* Grt. Sudbury, Ont., (Evans).

1,789. *Mamestra capsularis* Gn. Aweme, Man., June 18, 28, two specimens, (Criddle).

1,806. *Mamestra rubefacta* Morr. Millarville, Alta., one at treacle, June 25, (Dod).

1,827. *Mamestra obscura* Sm. Trenton, Ont., June 2, (Evans).

1,874. *Mamestra tacoma* Strk. Ottawa, June 6, (Gibson); Trenton, Ont., (Evans).

1,877. *Mamestra circumvadis* Sm. Millarville, Alta., one male at light, July 10 (Dod).

1,951. *Nephelodes pectinatus* Sm. Millarville, Alta., Aug. 17, at light, (Dod).

1,983. *Leucania calgariana* Sm. Millarville, Alta., a few at treacle, July 5 to 20, (Dod).

2,012. *Graphiphora culea* Gn. Trenton, June 14, (Evans).

2,072. *Aporophila yosemitae* Grt. Hymers, Ont., Sept. 12, (Dawson).

2,111. *Xylina thaxteri* Grt. Hymers, Ont., Sept. 2, (Dawson); McNab's Island, Halifax, N.S., June 12, (Perrin).

Cucullia indicta Sm. Millarville, Alta., one male, at Burgamot, Aug. 1, rare; this will probably prove to be synonymous with *obscurior* of Smith, (Dod).

Gortyna pallescens Sm. Millarville, Alta., one about Sept. 8, disturbed from a bunch of hay, a frequent method of capture in some previous years. My note in the Record for 1906 should have referred to this species and not *medialis* Sm., of which I have seen typical specimens from Colorado which look distinct, (Dod).

Gortyna thalictri Lyman. Aweme, Man., Oct. 1, (Criddle); a poor speciman of what I think is this species was taken this year at Winnipeg by Mr. Wallis. The variety *perobsoleta,* Lyman, was collected the past season at Hymers, Ont., by Mr. Dawson.

Gortyna nepheleptena Dyar. Ottawa, Sept. 23, (Fletcher); Oct. 17, (Gibson). The first Canadian records.

2,200. *Xanthia pulchella* Sm. Duncans, B.C., Sept., over 20 specimens taken at sugar. During previous residence of six years on Vancouver Island, had only taken two specimens, (Hanham).

2,214. *Tapinostola variana* Morr. Britannia, near Ottawa, July 28, (Baldwin); Trenton, Ont., another specimen taken July 31, (Evans).

2,221. *Orthosia ralla* G. & R. Trenton, Ont., Aug. 20, (Evans).

2,301. *Heliothis phlogophagus* G. & R. Winnipeg, Man., Oct. 2, (Wallis).

Polychrysia trabea Sm. Millarville, Alta., July 23 to Aug. 9, about thirty specimens, principally at flowers of Larkspur, on which the larva in all probability feeds. I have clusters of these flowers in my garden, but those growing wild attracted by far the greater number. These captures are an interesting discovery, as the food plant of *moneta* in Europe is Monkshood, which belongs to the same family. The only constant difference between the European and North American forms appears to be that the latter is slightly paler in colour. I have not seen typical Siberian *esmeralda,* (Dod).

2,481. *Eosphoropteryx thyatiroides* Gn. Duncans, B.C., a single specimen at bloom in my garden in 1908 and another in 1909; a rare visitant on Vancouver Island, (Hanham).

2,494. *Autographa rubidus* Ottol. Millarville, Alta., June 23 to July 5, six specimens, five of them at treacle. It is unusual for this genus to come to treacle in this district, and the capture of five specimens by this means suggests that I might have found the species common had I discovered its favourite flower, as I did *trabea,* (Dod).

2,528. *Autographa sackeni* Grt. Millarville, Alta., one worn specimen flying in sunshine, Aug. 1, (Dod).

2,529. *Autographa snowi* Hy. Edw. "Head of Pine Creek, Calgary" (the locality usually cited in this Record, with equal correctness, as "Millarville"), July 23, 1905, (Dod), and Mt. Athabasca, Alberta Rockies, July 31, 1907, (Mrs. Nicholl). Both specimens are in the British Museum and agree fully with the description and with Ottolengui's figure. So far as I know these are the first correct records from Canada. The resemblance to *sackeni* is very close, (Dod).

Syngrapha microgramma Hbn. Millarville, Alta., July 1 to 12, 1903 and 1904. This is the species erroneously recorded by me as *snowi* in Can. Ent., xxxvii, 45. I took a specimen to the British Museum and found that it fully agreed with European specimens, so that the name must now be added to our lists, (Dod).

2,540. *Ogdoconta cinereola* Gn. Cartwright, Man., 1 sp. Sept. 24, very rare here, (Heath); Winnipeg, Man., Sept. 20, (Wallis).

2,682. *Tarache cretata* G. & R. Trenton, Ont., June 14, 25, (Evans).

2,724. *Phalaenostola larentioides* Grt. Trenton, Ont., July 3, (Evans).

2,728. *Hyamia perditalis* Walk. Trenton, Ont., 2 sp. July 2, Aug. 3, (Evans).

2,769. *Meliopotis limbolaris* Geyer. McNab's Island, Halifax, July 16, (Perrin).

2,777. *Cirrhobolina deducta* Morr. Millarville Alta., one worn female at treacle, July 5; new to Alberta, and, I believe, a great rarity in Canada, (Dod).

2,825. *Catocala elda* Behr. Duncans, B.C., (Hanham).

2,836. *Catocala luciana* Hy. Edw. Cartwright, Man., Aug. 22, very rare, (Heath).

2,868. *Catocala piatrix* Grt. Pt. Pelee, Ont., Aug. 14, (P. A. Taverner).

2,990. *Homoptera minerea* Gn. Trenton, Ont., June 7, (Evans).

Pheocyma largera Sm. Penticton, B.C., (L. A. De Wolfe).

3,006. *Erebus odora* L. Pt. Pelee, Ont., Sept. 8, (P. A. Taverner); Quebec, Que., July 28, (Fyles); Brandon, Man., record sent by Mr. Willing.

3,038. *Philometra hanhami* Sm. Trenton, Ont., July 11, 29, (Evans). This is only the second time this species has been taken in the East.

3,136. *Heterocampa umbrata* Walk. Winnipeg, June 24, (Wallis).

3,159. *Cerura scitiscripta* Walk., a. *multiscripta* Riley. Winnipeg, June 22, (Wallis); Aweme, Man., (Criddle).

3,193. *Olene achatina* S. & A. Trenton, Ont., July 19, (Evans).

3,238. *Opheroptera boreata* Hbn. Trenton, Ont., Oct. 28, 29, two specimens, (Evans).

3,240. *Rachela bruceata* Hulst. Kaslo, B.C., (Cockle). New to British Columbia, (G. W. T.).

Rachela pulchraria Taylor. Kaslo, B.C., (Cockle).

3,272. *Eupithecia luteata* Pack. Trenton, Ont., 2 sp., July 22, Aug. 6, (Evans).

3,282. *Eupithecia albicapitata* Pack. One specimen labelled "E. Ontario," (Evans).

Eupithecia packardata Taylor. Trenton, Ont., Aug. 16, (Evans).

Eupithecia placidata Taylor. Kaslo, B.C., (Cockle).

Eupithecia agnesata Taylor. Kaslo, B.C., (Cockle).

Eupithecia terminata Taylor. Kaslo, B.C., (Cockle).

Eupithecia slocanata Taylor. Kaslo, B.C., (Cockle).

Eupithecia minorata Taylor. Kaslo, B.C., (Cockle).

Eupithecia adornata Taylor. Kaslo, B.C., (Cockle).

Eupithecia hanhami Taylor. Ucluelet, B.C., (Young).

Eupithecia harveyata Taylor. Ucluelet, B.C., (Young).

Eupithecia casloata Dyar. Ucluelet, B.C., (Young).

Eupithecia compactata Taylor, MS. Ucluelet, B.C., (Young).

Eupithecia albipunctata Haw. Ucluelet, B.C., (Young). This species is recorded in *Canadian Entomologist,* Dec., 1909, p. 428. I had not seen it from Vancouver Island before, (G. W. T.).

Eucymatoge togata Hbn. Departure Bay, B.C., (Taylor).

3,328. *Eucymatoge vitalbata* D. & S. Kaslo, B.C., (Cockle). New to British Columbia, (G. W. T.).

Eutephria lagganata Taylor. Laggan, B.C., (Dod).

Eutephria takirata Taylor. Takir R., B.C., (T. Bryant).

Aplodes unilinearia Taylor. Kaslo, B.C., (Cockle); Victoria, B.C., (Harvey).

Sciagraphia purcellata Taylor. Kaslo, B.C., (Cockle).

3,706. *Cymatophora bitactata* Walk. Kaslo, B.C., (Cockle). New to British Columbia, (G. W. T.).

3,734. *Cymatophora denticulodes* Hulst. Kaslo, B.C., (Cockle); Similkameen, B.C., (Harvey).

3,767. *Caripeta aequaliaria* Grt. Departure Bay, B.C., (Taylor).

3,835. *Selidosema separataria* Grt. Kaslo, B.C., (Cockle). New to British Columbia, (G. W. T.).

3,922. *Ennomos subsignarius* Hbn. Another visitation of these moths appeared at Ottawa on Aug. 5 and 6. Although great swarms were seen, the numbers did not seem so large as last year, (Groh). Mr. Winn, also, reports that the moths were abundant at Montreal, at intervals, in August.

4,040. *Leucobrephos brephoides* Walk. Winnipeg, Man., April 17, (Wallis).

4,043. *Callizzia amorata* Pack. Trenton, Ont., 2 sp., June 18, Aug. 1, (Evans).

4,274. *Lipocosma fuliginosalis* Fern. Trenton, Ont., 6 sp., July 2, 5, 11, 18, 29, (Evans).

Blepharomastix nymphulalis Haimback. St. Johns, Que., July 24, (Chagnon).

4,400. *Perispasta caeculalis* Zell. Trenton, Ont., 2 sp., June 14, 25, (Evans).

4,484. *Lineodes integra* Zell. Trenton, Ont., Sept. 13, (Evans).

Paralipsa terrenella Zell. Trenton, Ont., June 24, (Evans).

4,514. *Pyralis cuprina* Zell. Trenton, Ont., July 11, (Evans).

4,519. *Pyralis cohortalis* Grt. Trenton, Ont., June 27, July 29, (Evans).

4,546. *Schoenobius clemensellus* Rob. Trenton, Ont., July 1-29, (Evans).

4,560. *Crambus hamellus* Thunb. Kamouraska, Que., Aug. 19, (Winn).

4,566. *Crambus unistriatellus* Pack. Trenton, Ont., 2 sp., July 9, 26, (Evans).

4,574. *Crambus alboclavellus* Zell. Trenton, Ont., July 2-25, (Evans).

4,587. *Crambus ruricolellus* Zell. Trenton, Ont., 1 sp., July 3, (Evans).

Thaumatopsis gibsonella Kearf. Trenton, Ont., 1 sp., Sept. 5, (Evans). Second Ontario record.

4,599. *Crambus oregonicus* Grt. Departure Bay, B.C., (Young).

4,622. *Argyria auratella* Clem. Trenton, Ont., 3 sp. July 6, 9, (Evans).

4,632. *Chilo forbesellus* Fern. Trenton, Ont., 4 sp. July 11, 14, 27, 29, (Evans).

4,633. *Chalcoela aurifera* Zell. Trenton, Ont., 1 sp. July 22, (Evans).

4,698. *Mineola tricolorella* Grt. Trenton, Ont., 2 sp., July 2, 11, (Evans).

4,734. *Nephopteryx ovalis* Pack. Trenton, Ont., July 2-17, (Evans).

4,748. *Meroptera unicolorella* Hulst. Trenton, Ont., June 18, July 11, Aug. 17, (Evans).

4,835. *Euzophera ochrifrontella* Zell. Trenton, Ont., July 9, (Evans).

4,871. *Homœosoma mucidellum* Rag. Trenton, Ont., June 13, 20, July 25, Aug. 2, 23, (Evans).

4,886. *Moodna ostrinella* Clem. Trenton, Ont., June 17, (Evans).

4,888. *Moodna pelviculella* Hulst. Trenton, Ont., July 24-30, Aug. 14, (Evans).

4,973. *Pterophorus paleaceus* Zell. Trenton, Ont., 2 sp., June 20, 21, (Evans).
5,033. *Olethreutes capreana* Hbn. Trenton, Ont., 1 sp., July 2, (Evans).
5,057. *Olethreutes constellatana* Zell. Trenton, Ont., 2 sp., June 18, 22, (Evans).
Olethreutes removana Kearf. Trenton, Ont., 2 sp., July 3, 4, (Evans).
5,121. *Eucosma juncticiliana* Wlsm. Trenton, Ont., 3 sp., July 17, 23, Aug. 1, (Evans).
5,134. *Eucosma trigeminana* Steph. Trenton, Ont., 1 sp., June 20, (Evans).
5,140-1. *Eucosma obfuscana* Riley. Isle of Montreal, Que., June 13, (Chagnon). Closely allied to *E. scudderiana* Clem., and, like this species, the larvæ will be found making galls in the stems of aster, or goldenrod, (W. D. K.).
Eucosma landana Kearf. Redvers, Sask., (A. J. Crocker).
5,142. *Eucosma otiosana* Clem. Trenton, Ont., 7 sp., June 25, Aug. 30, (Evans).
5,167. *Thiodia aspidiscana* Hbn. Trenton, Ont., 5 sp., June 7. 13, 14, 22, (Evans).
Thiodia essexana Kearf. Trenton, Ont., 1 sp., June 12, (Evans).
Epinotia plumbolineana Kearf. Departure Bay, B.C., (Young).
5,248. *Ancylis burgessiana* Zell. Trenton, Ont., 2 sp., June 18, Aug. 6, (Evans).
5,253. *Ancylis angulifasciana* Zell. Trenton, Ont., 1 sp., July 11, (Evans).
Enarmonia vancouverana Kearf. Redvers, Sask., (A. J. Crocker).
5,295. *Melissopus latiferreanus* Walsm. Mt. St. Hilaire, Que., June 25, (Chagnon). The larvæ may be found during the winter in fallen acorns, usually in company with a Buprestid larva, also an Holocera larva. Sometimes all three may be found in the same acorn, (W. D. K.).
5,353. *Sparganothis flavibasana* Fern. Ottawa, larvæ again abundant on a few cultivated Loniceras, mature June 15, (Gibson).
5,387. *Platynota sentana* Clem. Trenton, Ont., 1 sp., June 27, (Evans).
5,396. *Tortrix pallorana* Rob. Trenton, Ont., 2 sp., Aug. 29, Sept. 5, (Evans).
5,406. *Tortrix fumiferana* Clem. Ottawa, thousands of the moths flying around trees and shrubs in the district, July 20, (Gibson).
5,435. *Phalonia smeathmanniana* Fab. Trenton, Ont., 7 sp., June 22, July 17, (Evans).
Histerosia cartwrightiana Kearf. Trenton, Ont., 1 sp., June 27, (Evans).
5,496. *Cerostoma cervella* Wlsm. Departure Bay, B.C., (Young).
5,661. *Trichotaphe nonstrigella* Cham. Trenton, Ont., 6 dates, June 21-Sept. 23, (Evans).
Gelechia viduella Fab. Banff, Alta., 1 sp. (Sanson). An arctic species, very rarely found, described as *labradoriella* by Clemens, from specimens collected by Packard. There seems to be no other record of its capture since 1863, (W. D. K.).
5,818. *Gelechia ornatifimbriella* Clem. Trenton, Ont., 9 dates, June 14—July 2, (Evans).
Psilocorsis fletcherella Gibson. Ottawa, 2 sp. emerged from larvæ found on *Populus tremuloides* June 10, (Gibson).
6,110. *Scythris impositella* Zell. Ottawa, Mer Bleue, (Young).
6,495. *Tinea biflavimaculella* Clem. Trenton, Ont., 2 sp., July 3, Sept. 5, (Evans).
6,606. *Sthenopis thule* Strk. Macdonald College, Que., larvæ and pupæ found near here in bases of the stems of *Salix petiolaris,* June 29, (Swaine and Chagnon).

Coleoptera.

(Arranged according to Henshaw's List of the Coleoptera of America, North of Mexico).

28. *Cicindela fulgida* Say. Peachland, B.C., (Wallis).
30*a*. *Cicindela limbata* Say. Radisson, Sask., July 27, (Fletcher).
34*a*. *Cicindela terricola* Say. Westbourne, Man., Aug. 24, (Wallis). New to Manitoba.
167. *Loricera caerulescens* L. Aweme, Man., (Criddle).
305. *Bembidium carinula* Chd. Winnipeg Beach, Man., July 9, (Wallis).
351. *Bembidium lucidum* Lec. Winnipeg, Man., May 6, (Wallis).
569. *Pterostichus caudicalis* Say. Winnipeg, May 8, (Wallis).
623. *Amara avida* Say. Winnipeg, Sept. 9, (Wallis).
626. *Amara rufimanus* Kirby. Westbourne, Man., Aug. 5, (Wallis).
629. *Amara laticollis* Lec. Winnipeg, Aug. 8, (Wallis).
650. *Amara apricarius* Payk. Trenton, Ont., 4 specimens, July 4, 11, 23, Aug. 5, (Evans).
742. *Calathus gregarius* Say. Westbourne, Man., Aug. 14, (Wallis).
777. *Platynus anchomenoides* Rand. Aweme, Man., (Criddle).
804. *Platynus basālis* Lec. Aweme, Man., (Criddle).
836. *Platynus nigriceps* Lec. Radisson Sask., July 29, (Willing).
871. *Lebia divisa* Lec. Last Mountain Lake, Sask., June 5, (G. C. McBean).
898. *Lebia depicta* Horn. Makinak, Man. Record sent by Mr. Chagnon, of Montreal.
Colymbetes rugipennis Sharp. Winnipeg, Sept. 19, (Wallis). Mr. Roberts, of New York, who identified the species, writes: "You will find this placed as a synonym of *sculptilis;* this is an error. I can prove it to be a good species."
925. *Callida purpurea* Say. Wilkie, Sask., July 16, (Willing).
947. *Cymindis borealis* Lec. Aweme, Man., (Criddle).
1,450. *Agabus clavatus* Lec. Vernon, B.C., (Venables).
1,484. *Dytiscus marginicollis* Lec. Winnipeg, April 24, (Wallis).
1,500. *Graphoderes occidentalis* Horn. Winnipeg, (Wallis).
1,505. *Gyrinus minutus* Fab. Winnipeg, Sept. 11, (Wallis).
1,551. *Helophorus inquinatus* Mann. Winnipeg, May 5, (Wallis).
1,597. *Hydrocharis obtusatus* Say. Winnipeg, June 3, (Wallis).
1,679. *Cercyon unipunctatum* L. Regina, Sask., in house, Nov., (Willing).
1,729. *Choleva basillaris* Say. Aweme, Man., (Criddle).
1,735. *Ptomaphagus consobrinus* Lec. Aweme, Man., (Criddle).
1,743. *Ptomaphagus brachyderus* Lec. Aweme, Man., (Criddle).
1,866. *Ceophyllus monilis* Lec. Aweme, Man., (Criddle).
Coccidula occidentalis Horn. Aweme, Man., (Criddle).
2,098. *Quedius explanatus* Lec. Olds, Alta., in a turnip, Sept. 12, (Willing).
2,234. *Philonthus aurulentus* Horn. Vernon, B.C., (Venables).
3,037. *Megilla vittiger* Mann. Saskatoon, Sask., June 1; Olds, Alta., Sept. 12, (Willing).
3,072. *Harmonia 12-maculata* Gebl. Last Mountain Lake, Sask., 3 specimens, each a different colour, June 5, (G. A. McBean).

3,095*d*. *Brachyacantha albifrons* Say. Meota, north of Battleford, Sask., Aug. 8, (Willing).
3,122. *Hyperaspis 4-vittata* Lec. Last Mountain Lake, Sask., June 5, (G. A. McBean).
Hyperaspis inflexa Casey. Last Mountain Lake, Sask., June 5, (G. A. McBean).
3,189. *Mycetina testacea* Ziegl. Regina, Sask., Aug. 28, (Willing).
3,238. *Tritoma californica* Lec. Olds, Alta., (Willing).
3,355. *Telmatophilus americana* Lec. Aweme, Man., (Criddle).
3,421. *Dermestes talpinus* Mann. Olds, Alta., (Willing).
3,425*a*. *Dermestes signatus* Lec. Olds, Alta., (Willing).
3,477. *Hister harrisii* Kirby. Aweme, Man., June, July, (Criddle); Westbourne, Man., Aug., (Wallis).
3,505. *Hister sedecimstriatus* Say. Aweme, June, (Criddle).
3,508. *Hister perplexus* Lec. Aweme, Man., June, (Criddle).
3,615. *Saprinus seminitens* Lec. Aweme, Man., July, (Criddle).
3,617. *Saprinus fraternus* Say. Aweme, Man., July, (Criddle).
3,895. *Byrrhus murinus* Fab. Aweme, Man., (Criddle).
4,282. *Agriotes fucosus* Lec. Winnipeg, July 7, (Wallis).
4,322. *Melanotus fissilis* Say. Westbourne, Man., Aug. 14, Wallis).
4,382. *Pityobius anguinus* Lec. Winnipeg Beach, Man., July 9, (Wallis).
4,607*a*. *Buprestis langii* Mann. Banff, Alta., July 16, (Sanson).
4,810. *Lucidota atra* Fab. Norman, Ont., July 19, (Wallis).
5,235. *Gibbium scotias* Scop. Montreal, June, (Chagnon).
5,296. *Xyletinus lugubris* Lec. Aweme, Man., (Criddle).
5,337. *Endecatomus rugosus* Rand. Aweme, Man., (Criddle).
5,356. *Amphicerus bicaudatus* Say. Regina, Sask., Sept. 17, Oct. 6, (Willing).
5,428. *Canthon praticola* Lec. Mortlach, Sask., in dead gophers, May 31, (Willing).
5,705. *Diplotaxis obscura* Lec. Vernon, B.C., (Venables).
5,960. *Prionus pocularis* Dalm. Trenton, Ont., July 13, (Evans).
6,007. *Merium proteus* Kirby. Vernon, B.C., (Venables).
6,184. *Xylotrechus annosus* Say. Regina, Sask., June 12; Strathcona, Alta., May 20, (Willing).
6,253. *Anthophylax malachiticus* Hald. Mt. St. Hilaire, Que., May 24, (Chagnon).
6,266. *Acmæops subpilosa* Lec. High River, Alta, June 27, (Willing).
6,278. *Gaurotes cressoni* Bland. Vernon, B.C., on wild rose flowers, Aug., (Venables).
6,358. *Leptura scripta* Lec. Vernon, on wild rose, (Venables).
6,385. *Monohammus titillator* Fab. Trenton, Ont., Aug. 9, (Evans).
6,488. *Saperda moesta* Lec. Garden Hill, near Port Hope, Ont. Middle July, on poplar, (Morris).
6,489. *Saperda concolor* Lec. Bethel, near Port Hope, Ont. Middle June, on willow, (Morris).
6,659. *Pachybrachys litigiosus* Suffr. Aweme, Man., July 9, (Criddle).
6,684. *Pachybrachys nigricornis* Say. Aweme, Man., July 19, only one specimen taken, (Criddle).
6,707. *Diachus auratus* Fab. Aweme, Man., Aug. 18, 25, (Criddle).
6,742. *Chrysochus cobaltinus* Lec. Enderby, B.C., Aug. Several on heads of timothy grass, (Venables).

6,796. *Chrysomela conjuncta* Rog. Last Mountain Lake, Sask., June 5, (G. A. McBean).
6,968. *Haltica evicta* Lec. Aweme, Man., (Criddle).
7,032. *Mantura floridana* Cr. Aweme, Man., May 28, on *Rumex venosus,* (E. Criddle).
7,096. *Physonota unipunctata* Say. Qu'Appelle Valley, July, (Halkett).
7,402. *Haplandrus femoratus* Fab. Montreal, (Chagnon).
Vanonus wickhami Casey. Trenton, Ont., July 18, (Evans).
7,464. *Tribolium madens* Charp. Vernon, B.C., (Venables).
8,224. *Attelabus analis* Ill. Aweme, Man., (Criddle).
8,228. *Attelabus rhois* Boh. Aweme, Man., (Criddle).
8,334. *Scythropus elegans* Coup. Vernon, B.C., beaten from pine trees, (Venables).
8,430. *Phytonomus comptus* Say. Aweme, Man., on *Rumex venosus,* (Criddle); pupa on head of grass, Indian Head, emerged Regina, Sask., Aug. 1, (Willing).
8,540. *Grypidius equiseti* Fab. Winnipeg, Man., May 23, (Wallis).
8,641. *Anthonomus sycophanta* Walsh. Regina, Sask., June 10; reared from gall on willow leaf, Olds, Alta., Sept. 5, (Willing).
8,688. *Encalus decipiens* Lec. Aweme, Man., May 28, (Criddle).
8,943. *Limnobaris prolixa* Lec. Aweme, Man., (Criddle).
8,948. *Limnobaris prolexus* Lec. Aweme, Man., (Criddle).
9,199. *Hylurgops pinifex* Fitch. Winnipeg, May 9, (Wallis).
9,207. *Allandrus bifasciatus* Lec. Aweme, Man., (Criddle).
9,315. *Philhydrus hamiltoni* Horn. Norman, Ont., July 19, (Wallis).
Actium retractum Casey. Queen Charlotte Island, B. C., (Keen).
Oropus keeni Casey. Metlakatla, B.C., (Keen).
Oropus brevipennis Casey. Metlakatla, B.C., (Keen).
Batrisodes albionicus Aubé. Metlakatla, B.C., (Keen).
Baryodma rotundicollis Casey. Queen Charlotte Island, B.C., (Keen).
Baryodma insulana Casey. Queen Charlotte Island, B.C., (Keen).
Eucharina sulcicollis Mann. Queen Charlotte Island, and Metlakatla, B.C., (Keen).
Megista granulata Mann. Queen Charlotte Island, B.C., (Keen).
Thinusa fletcheri Casey. Queen Charlotte Island, B.C., (Keen).
Amblopusa borealis Casey. Queen Charlotte Island, (Keen).

Diptera.

(Arranged according to a Catalogue of North American Diptera, by J. M. Aldrich, Smithsonian Misc. Coll. XLVI., No. 1,144. The numbers refer to the pages of the catalogue.)

Collectors who other years devoted a good deal of time to these insects have omitted to send in records. It is hoped, however, when the past season's collections are worked up, that notes relating to the rarer species will be sent for inclusion in next year's Record.

87. *Chionea nivicola* Doane. Banff, Alta., on snow, March 29, (Sanson).
105. *Dixa centralis* Loew. Banff, Alta., June 22, (Sanson).
Anopheles occidentalis D. & K. Valley of Mayo River, Y.T., Lat. 63° 45′, Long. 136°, 1904, (Keele). Probably the most northerly record for an *Anopheles* (H. G. D.); Aweme, Man., April 23, 24, (Criddle).

127. *Aedes canadensis* Th. Youghall, N.B., July, (Gibson).
129. *Culiseta impatiens* Walk. Valley of Mayo River, Y.T., Lat. 63° 45′, Long. 136°, 1904, (Keele).
129. *Culiseta inornatus* Will. Aweme, Man., May 17, 21, Sept. 27, Oct. 12, 14, (Criddle).
131. *Aedes provacans* Walk. Youghall, N.B., July, (Gibson).
Aedes sansoni D. & K. Banff, Alta., June 22, (Sanson).
Aedes punctor Kirby. Banff, Alta., June 22, (Sanson).
Aedes pagetonotum D. & K. Ottawa, May 20, 1905, (Fletcher); Chelsea, Que., May 17, (Gibson); Aweme, June 3, (Criddle).
Aedes riparius D. & K. Aweme, Man., June 1, 2, 24, (Criddle).
131. *Aedes sylvestris* Th. Aweme, Man., June 25, July 19, (Criddle); Youghall, N.B., July, (Gibson).
133. *Aedes spenceri* Th. Aweme, Man., May 17, June 10, (Criddle).
Mansonia perturbans Walk. Aweme, Man., June 30, (Criddle).
182. *Stratiomyia badia* Walk. Beaver Lake, Alta., July, (Halkett).
185. *Odontomyia binotata* Loew. Aweme, Man., Aug. 25, (Fletcher).
359. *Platychirus chætopodus* Will. Metlakatla, B.C., (Keen).
360. *Melanostoma angustatum* Will. Kaslo, B.C., Aug. 16, (Fletcher).
363. *Didea laxa* O.S. Fort Simpson, B.C., Aug. 18, (Keen).
365. *Syrphus diversipes* Macq. Hampton, P.E.I., Aug. 20, (Gibson).
Syrphus perplexus Osburn. Millie Lake, Hudson Bay Slope, July 27, (Wilson).
367. *Syrphus protritus* O.S. Metlakatla, B.C., (Keen).
368. *Syrphus xanthostoma* Will. Hampton, P.E.I., Aug. 20, (Gibson): Ottawa, Sept. 4, (Groh).
382. *Sericomyia chrysotoxoides* Macq. Youghall, N.B., July 6, (Gibson).
393. *Helophilus hamatus* Loew. Ottawa, May 13, (Fletcher).
568. *Scatophaga furcata* Say. Banff, Alta., on Sulphur Mountain, May, (Sanson).

HEMIPTERA.

In this order some good work has been done during the year by Mr. Geo. A. Moore, of Montreal. Other collectors who previously have devoted considerable time to collecting hemiptera have either omitted to send in records, or have not as yet been able to work up their season's catch. Mr. Moore spent the latter half of July at North Hatley, Que., and among the material which he collected the following, although most of the species may not be particularly uncommon, are of interest, as few definite records from that part of the Province of Quebec are available. All the specimens were collected between the 17th and 31st July, at North Hatley, and were not of common occurrence:

Entilia sinuata, Fab.
Lamenia vulgaris, Fitch.
Laccocera vittipennis, Van D.
Pissonotus marginatus, Van D.
Aphrophora quadrinotata, Say.
Agallia 4-punctata Prov.
Oncometopia lateralis Fab.
Gypona quebecensis Prov.
Corimelaena unicolor, P. B.
Perillus circumcinctus, Stal.
Homoemus aeneifrons, Say.
Podisus modestus, Dall.
Mormidea lugens, Fabr.
Peribalus limbolaris, Stal.
Elasmostethus cruciata, Say.
Corizus nigrosternum, Sign.
Corizus novae-boracensis, Sign.
Nysius angustatus, Uhl.
Oedancala dorsalis, Say.
Lopidea media, Say.
Resthenia insignis, Say.
Lygus pabulinus, L.

Neurocolpus nubilis, Say.
Poeciloscytus basalis, Reut.
Capsus ater, L.
Dicyphus famelicus, Uhl.
Diaphnidia pellucida, Uhl.
Pilophorus amoenus, Uhl.
Rhinocapsus vanduzei, Uhl.
Coriscus subcolcoptratus, Kirby.
Gerris rufoscutellatus, Latr.
Rhagovelia obesa, Uhl.
Salda ligata, Say.
Salda pallipes, Fabr.

Besides the above, the following records are of interest, those species taken by Mr. Metcalfe, being new to the Ottawa list:

Livia maculipennis Fitch. Ottawa, on pine, April 30, (Metcalfe).

Livia vernalis Fitch. Ottawa, on pine, April 30, (Metcalfe).

Aphalara calthae Linn. Hull, Que., May 10, (Metcalfe).

Aphalara marginata Harris. Hull, Que., June 7, (Metcalfe).

Psylla carpini Fitch. Hull, Que., on ironwood, Aug. 25, (Metcalfe).

(The above species of Psyllidae were named by Mr. E. A. Schwarz, of Washington. A number of other species besides these were collected, but Mr. Schwarz reported them to be undescribed.)

Gypona albosignata Uhl. Trenton, Ont., Sept. 5, 1 sp., rare, (Evans).

Athysanus striola Fall. Trenton, Ont., June 18, 2 sp., rare, (Evans).

Athysanus instabilis Van D. Trenton, Ont., 5 sp., June 23, July 21, 23, 28, Aug. 1, (Evans).

Sehirus cinctus P. B. Large numbers of this insect were seen by Miss A. M. Rand, at Canaan, N.S., in early April, chiefly being clustered on old leaves under, and near, apple trees. Its occurrence in such large numbers seems to me should be recorded, as it is not a common habit among the Pentatomidæ. Mr. Van Duzee says this is the second instance known to him of this insect appearing in large numbers.

Corynocoris distinctus Dall. Sudbury, Ont.; Eldorado, Ont., Sept. 1, (Evans).

Alydrus pluto Uhler. Crow's Nest Pass, B.C., (W. S. Drury).

Alydrus conspersus Mont. Trenton, Ont., (Evans).

Alydrus scutellatus Van D. Crow's Nest Pass, B.C., (W. S. Drury).

Protenor belfragei Hagl. Sudbury, Ont.; Eldorado, Ont., Sept. 1, (Evans).

Phlegyas abbreviatus Uhler. Belleville, Ont., (Evans).

Corizus crassicornis L. Sudbury, Ont., June 23; Hastings Co., Ont., June 26, (Evans).

Cymus luridus Stal. Trenton, Ont., Aug. 17, (Evans).

Ligyrocoris diffussus Uhler. Trenton, Ont., Sept. 1, (Evans).

Ligyrocoris contracta Say. Crow's Nest Pass, B.C., (W. S. Drury).

Geocoris bullatus Say. Belleville, Ont., (Evans); N.W.T., (J. Macoun); Crow's Nest Pass, B.C., (W. S. Drury).

Resthenia insitiva Say. Belleville, Ont., (Evans).

Diaphnidia debilis Uhler. Trenton, Ont., Sept. 3, (Evans).

Labops burmeisteri Stal. Sudbury, Ont., 1 sp., (Evans). Mr. Van Duzee remarks, "is new to the Canadian list, and, in fact, new to this continent, so far as published records are concerned. I have seen one more specimen, which was taken in the Adirondacks last summer. It was described from specimens taken in Siberia and Kamschatka."

Reduviolus roseipennis Reut. Trenton, Ont., June 7, Sept. 16, (Evans).

Pygolampis pectoralis Say. Trenton, Ont., (Evans).

Orthoptera.

During 1909, Dr. E. M. Walker has examined several small collections of Orthoptera for Canadians. Among these are some species which he considers should be recorded here, and of which he has sent me data. These are as follows:

Labia minor Burm. Aweme, Man., June 18, 28, 29, 3 males, 2 females; Sept. 11, 5 males, 2 females, (Criddle).

Chloealtis abdominalis Thomas. Regina, Sask., Sept. 5, 1 female, macropterous, (Willing).

Arphia xanthoptera Burm. There is a specimen of this insect in the collection of the late Dr. Wm. Brodie, labelled Toronto, 1880. It does not appear to be found about Toronto at the present time, but will doubtless be found on the southern strip along Lake Erie. New to Canada, (E. M. W.).

Spharagemon bolli Scudd. Aweme, Man., July 27, 1904, 1 female, (Criddle).

Spharagemon collare Scudd. Aweme, Man., Aug. 2, 1904, 1 male, (Criddle). This specimen is remarkably uniform in coloration, closely resembling *S. bolli* in appearance, (E. M. W.).

Ceuthophilus latens Scudd. There is a male of this species in the collection of the Ontario Agricultural College, Guelph, labelled, London, Ont. New to Canada, (E. M. W.).

Oecanthus quadripunctatus Beut. Aweme, Man., Aug. 21, 26, (Criddle).

Odonata.

Dr. E. M. Walker, of Toronto, has been good enough to send the following notes, all of which he thinks are worthy of recording in the Record:

Calopteryx aequabilis Say. Kenogami River, Hudson Bay Slope, Ont., July 7, 8, Aug. 7, 8, 1904, 4 males (Wilson). These specimens are somewhat stouter than those from more southern localities. They belong to the form described by Hagen as *C. hudsonica*.

Agrion resolutum Selys. Regina, Sask., June 20, (Willing).

Ischnura cervula Selys. Peachland, B.C., Aug. 20, (Wallis).

Ophiogomphus occidentis Hagen. Peachland, B.C., Aug. 6, 2 males, Aug. 17, 1 female, July 8, 1 male, (Wallis). New to Canada, (E. M. W.).

Gomphus descriptus Banks. Guelph, Ont., May 27, 1908, 1 male, (A. W. Baker). New to Canada, (E. M. W.).

Gomphus externus Selys. Aweme, Man., June 22, 1 male, (Criddle); Winnipeg, Man., (Wallis). New to Canada, (E. M. W.).

Aeshna umbrosa Walker. Winnipeg, Man., Sept. 6, (Wallis).

Aeshna eremita Scudder. Peachland, B.C., Aug. 3, 2,500 ft., 1 female; Aug. 7, 1 female, (Wallis).

Aeshna sitchensis Hagen. Winnipeg, Man., Sept. 6, 1 male, (Wallis).

Macromia magnifica Selys. Peachland, B.C., July 24, 31, 2 males (Wallis). Determined by Mr. E. B. Williamson. New to Canada, (E. M. W.).

Tetragoneuria canis McLachlan. Sudbury, June 26, 1892; June 11, 1893, 2 males, (Evans).

Somatochlora albicincta Burm. Aweme, Man., June 22, 1 female, (Criddle).

Cordulia shurtleffi Scudder. Sudbury, Ont., June 11, 1893, 2 males, (Evans).

Leucorhinia frigida Hagen. Sudbury, Ont., June 26, 1892, 1 male, 1 female, (Evans).

Leucorhinia hudsonica Selys. Winnipeg, June 19, 1 male, 3 females, (Wallis).

Leucorhinia proxima Calvert. Winnipeg, June 19, 1 male, (Wallis).

Leucorhinia borealis Hagen. Banff, Alta., (Sanson); again taken at Aweme, Man., June 4, 9, 2 females, (Criddle).

Leucorhinia intacta Hagen. Winnipeg, June 19, 2 males, (Wallis).

In addition to the above, Dr. Walker has written that he has several undetermined species received from Mr. J. B. Wallis, of Winnipeg, Man. Most of these

have been examined, also, by Mr. E. B. Williamson, but seem for the most part to be undescribed. They include an *Argia* from Peachland, B.C., (several specimens), a single female of a peculiar *Gomphus*, from the same locality, and 3 females of a *Somatochlora*, related to *franklini* and *macrotona*, but probably distinct. Dr. Walker also adds: "Among a number of Odonata used for class purposes, in the collection of the Ontario Agricultural College, Guelph, are a single *Perithemis domitia* Drury, and several specimens each of *Libellula vibrans* Fab., and *L. auripennis* Burm. These specimens are unlabelled, but Mr. Caesar, of the Entomological Department, thinks that they were certainly taken in the vicinity of Guelph. They cannot be recorded as undoubted inhabitants of Ontario, but should be looked for by collectors in the southern part of the province.

Neuropteroid Insects. (Except Odonata.)

With the publication of the list of some Canadian neuropteroid insects, exclusive of Odonata, in the Record for 1908, it was hoped that more work would be done in these groups in 1909. Mr. J. B. Wallis, of Winnipeg, has made another small collection, but all of these have not, as yet, been worked up. During the past year a miscellaneous lot of specimens has been determined by Dr. Banks, and it has been thought advisable, owing to the few authentic records of these insects in Canada, to include the entire list. There is much work to be done yet before we will have even a fair idea of the range of species which occur in Canada. The numbers below refer to the pages in Banks' Catalogue, published in 1907, by the American Entomological Society.

Archiptera.

15. *Polymitarcys albus* Say. Winnipeg, Man., Sept. 6, (Wallis).

15. *Hexagenia bilineata* Say. Norman, Ont., July 19, (Wallis).

16. *Hexagenia limbata* Pict. Winnipeg, July 3, (Wallis); Norman, Ont., subimagoes, July 19, (Wallis).

16. *Ephemera simulans* Walk. Ottawa, June 5, (Groh); Norman, Ont., July 19, (Wallis).

20. *Heptagenia interpunctata* Say. Norman, Ont., July 19, (Wallis).

21. *Heptagenia terminata* Walsh. Norman, Ont., July 19, (Wallis).

27. *Chrysopa chlorophana* Burm. Winnipeg, Man., Sept. 8, (Wallis).

27. *Chrysopa coloradensis* Banks. Peachland, B.C., Aug. 8, (Wallis).

Meleoma verticalis Banks. Penticton, B.C., Aug. 11, (Wallis).

29. *Myrmeleon immaculatus* De G. Penticton, B.C., Aug. 11, (Wallis).

30. *Brachynemurus abdominalis* Say. Okanagan Falls, B.C., Aug. 13, (Wallis).

31. *Brachynemurus brunneus* Currie. Peachland, B.C., Aug., (Wallis).

Neuroptera.

33. *Panorpa rufescens* Ramb. Ottawa, July 14, (Gibson).

Trichoptera.

35. *Phryganea cinerea* Walk. Rostrevor, Ont., Sept. 11, (Gibson); Regina, Sask., July 15, (Fletcher); Winnipeg, Man., June 25, (Wallis).

35. *Phryganea vestita* Walk. Sable Island, Aug. 16, (collector unknown).

35. *Neuronia angustipennis* Hagen. McLeod, Alta., June 30, (Fletcher).

35. *Neuronia postica* Walk. London, Ont., July 7, (A. P. Saunders).

36. *Limnephilus luteolus* Banks. Peachland, B.C., Aug. 8, (Wallis).

37. *Limnephilus submonilifer* Walk. Ottawa, Sept. 19, (Gibson), Sept. 26, (Letourneau); Rostrevor, Ont., Sept. 5, (Gibson).

38. *Pycnopsyche scabripennis* Ramb. Rostrevor, Ont., Sept. 4, (Gibson).

39. *Stenophylax pacificus* Banks. Peachland, B.C., Aug. 21, (Wallis).

39. *Platyphylax subfasciata* Say. Ottawa, Sept. 21, (Letourneau).

Platyphylax alaskensis Banks. Bartlett Bay, off Glacier Bay, Alaska, June 1, (Nelles).

41. *Apatania pallida* Hagen. Winnipeg, Man., Oct. 1, (Wallis).

42. *Brachycentrus nigrisoma* Banks. Winnipeg, Man., May 28, (Wallis).

45. *Molanna cinerea* Hagen. Rostrevor, Ont., Sept. 2, (Gibson).

45. *Triaenodes flavescens* Banks. Ottawa, June 25, (Gibson).

46. *Mystacides sepulchralis* Walk. Ottawa, Aug. 8, (Fletcher); Norman, Ont., July 19, (Wallis).

47. *Macronema zebrata* Hagen. St. Anne de Bellevue, Que., July 23, (Fletcher).

47. *Hydropsyche scalaris* Hagen. Norman, Ont., July 19, (Wallis).

47. *Hydropsyche sordida* Hagen. Ottawa, July 15, (Gibson).

Araneida.

The Rev. J. H. Keen, of Metlakatla, British Columbia, made a small collection of spiders, which were submitted to Dr. Nathan Banks. The list of determinations is of interest, owing to the locality, and to the fact that it adds considerably to the known range of some of the species. Dr. Banks considers the records all worth publishing. Unfortunately, no dates are given on which the specimens were collected. There is a good deal of work to be done yet in Canada in finding out what species of spiders we have, and many of our collectors, particularly those living in little worked localities, could help very much in adding to the known distribution of these creatures. The following, all of which were found at Metlakatla, constitute the list:

Epeira patagiata, Clerck.
Epeira displicata, Htz.
Epeira californiensis, Keys.
Zilla californica, Bks.
Labulla altioculata Keys. Not common, (N. B.).
Linyphia phrygiana, Koch.
Linyphia marginata, Koch.
Pedanostethus laticeps Keys. Previously known to me by a few specimens only, (N. B.).
Lophocarenum florens, Cambr.
Tetragnatha extensa, Linn.
Tetragnatha laboriosa, Hentz.
Apostenus cinctipes, Banks. Previously known to me by a few specimens only, (N. B.).
Clubiona pacifica, Banks.
Thanatus rubicundus, Keys.
Cybaeus reticulatus, Simon.
Amaurobius pictus, Simon.
Lycosa brunneiventris, Banks.
Pardosa glacialis, Thorell.
Dendryphantes bifida, Banks.
Sclerobunus brunneus, Banks.
Ideobisium threveneti, Simon.

IN MEMORIAM—DR. WILLIAM BRODIE.

We regret to have to record the death of another veteran entomologist, in the person of the late Dr. William Brodie, who has recently been contributing a series of articles on galls found in the neighborhood of Toronto. On Saturday, July 31st, he complained of feeling unwell on his return to his home, and a few days later became seriously ill. On Friday, August 6th, he expired. He was born in Peterhead, Aberdeen, Scotland, and came out to Canada with his parents when a child. His father settled on a farm in the County of York about thirty miles from Toronto, and there hewed out of the forest a home for his family. From his earliest years Dr. Brodie exhibited an ardent love of nature in all its aspects, and became an omnivorous reader. This habit formed in childhood continued with him throughout his life. While fitting himself for the profession of dentistry he taught school for a time and became one of the first graduates of the Dental College in Toronto. There he practised his profession very successfully for a long series of years. In 1903, he gave up his work and took charge of the Biological Department of the Provincial Museum. While fully occupied during most of his time with the work of his profession, he most industriously devoted every spare moment to his much-loved study of Entomology. Galls and their inmates had a special fascination for him, and he made large collections of these and many other forms of insect life. His enthusiasm was infectious and inspired many of his younger friends with a love for nature, and especially for the collection and observation of insects. He died at the good old age of seventy-eight years and will be very much missed, not only by the members of his family, but by a large circle of friends. His work at the Museum was most congenial to him, and gave him a happy occupation when his age prohibited him from carrying on his ordinary work. Of his family of six children, three daughters alone survive. To them we extend our deepest sympathy.

I.

Ah! you who own the sovereign sway
  Of commerce and the busy mart,
  You knew him not, he lived apart,
The king who passed in state to-day.

A king who recked not worldly gear,
  A pauper—you who rate by gold,
  But rich in knowledge manifold,
In Nature's lore without a peer.

He lived his threescore years and ten;
  He had his court of liegemen true;
  They loved him, like that chosen few
Who served the Master scorned of men.

"He is no king of ours," you say,
  "We know him not"; yet bare the head,
  Pay you your tribute, he is dead,
I saw him pass in state to-day.

II.

To bow the knee he was not planned
  With willowy grace and pliant form;
  Like stalwart oak he faced the storm
And bore the brunt—a monarch grand.

A shock of rebel locks upreared
  Above the forehead bold and high;
  'Neath shaggy brow the deep-set eye
Challenged enquiry; grizzled beard

Part hid his lip; a man endued
  With power of thought, you read the face;
  The Maker moulds in some for grace,
For strength those rugged features hewed.

In mind and will maturest man,
  A boy at heart; his eager quest
  Of Nature's ways the boy confessed,
But through it all endurance ran.

Bend as they might the sturdy frame
  And quell the lustre of the eye,
  Not years could daunt the purpose high
Or quench the ardent spirit's flame.

III.

Greybeard and youth, a thoughtful throng,
  Would gather round their Scottish sage,
  Right gladly youth give place to age,
Listen and learn and ponder long.

Was life's dark riddle hard to read?
  His vibrant tones would cheer. Were there
  Who questioned truth? who fought despair?
He welcomed all, nor asked their creed.

Did they in earnest seek? He sought
  In earnest too. From bounteous store
  He loved with lavish hand to pour
Jewels of knowledge and of thought.

Responsive hearts, unwavering eyes
  His steadfast gaze compelled again;
  He loved the truth, his speech was plain,
He could not stoop to compromise.

IV.

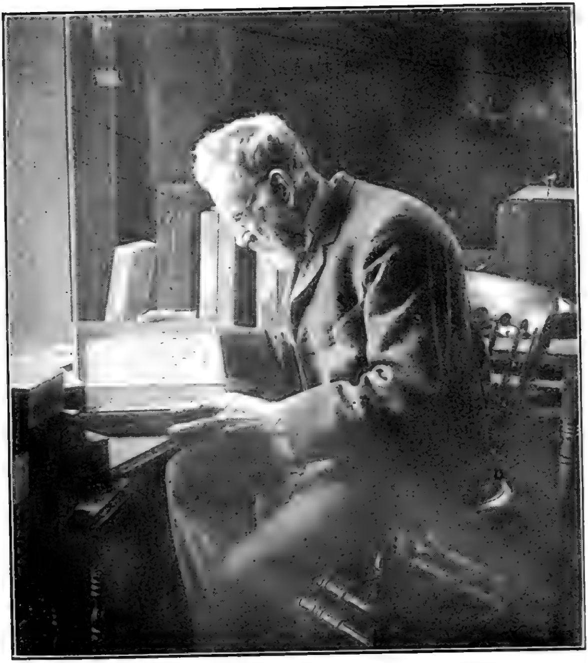
Oh! all too rare the thoughtful mind
  That keeps abreast of Science way
  And still reveres the older day,
The simpler faith that lags behind.

Dead now, but while the ages run
  His work shall live; 'tis such as he
  Alone inspire posterity,
Fathering their kind from son to son.

We know not when our days are sped,
  And I, who through his friendship stand,
  Would lift some falterer by the hand
Ere I lie nerveless with the dead.

—Frank Morris.

Trinity College School, Port Hope .



THE LATE DR WM. BRODIE.

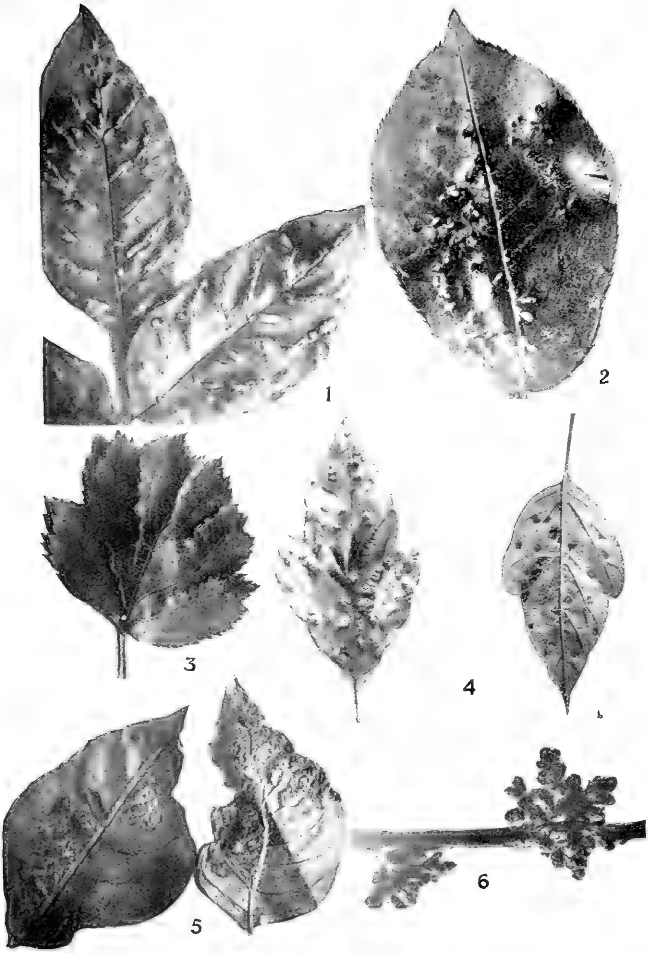


PLATE A.

1. Vein Gall on White Ash. *Eriophyes sp.*
2. Chokecherry Mite Gall. *Eriophyes sp.*
3. Hawthorn Serpentine Gall. *Eriophyes sp.*
4. Manitoba Maple Wart Gall. *Eriophyes sp.*
5. Poison Ivy Mite Gall. *Eriophyes sp.*
6. Birch Bud Gall. *Eriophyes sp.*

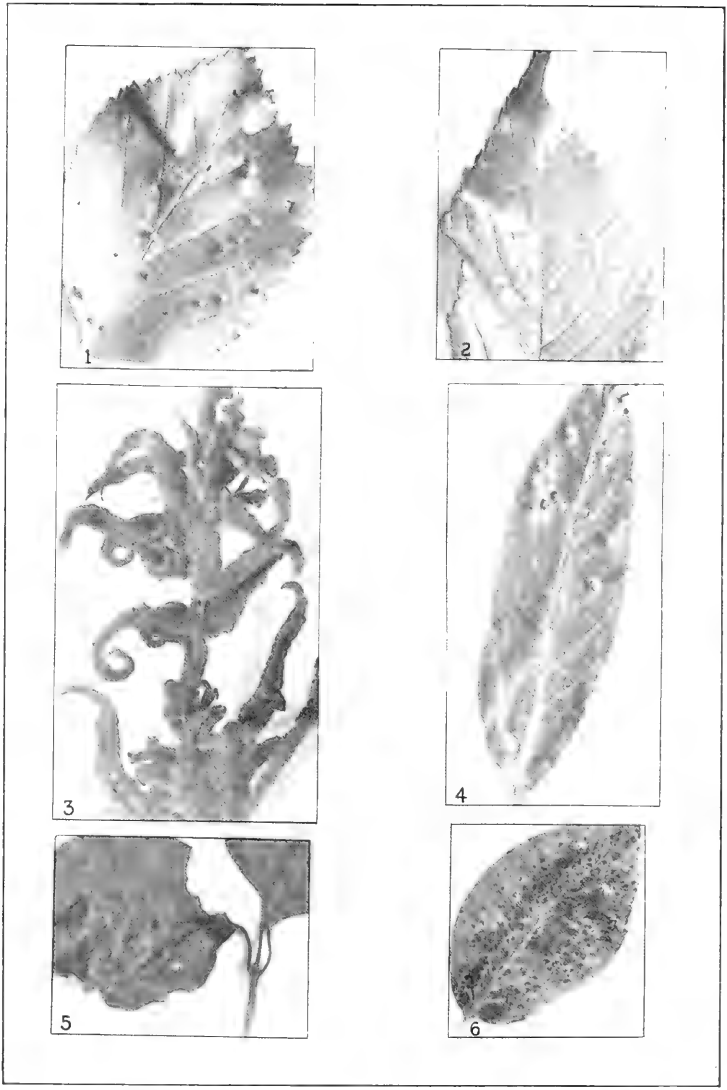


PLATE B.

1. Eriophyes sp., Betula papyrifera.
2. Eriophyes sp., Prunus Americana.
3. Eriophyes sp., Rhus Cotinus.
4. Eriophyes sp., Salix discolor.
5. Eriophyes cephalanthæ, Cephalanthus occidentalis.
6. Eriophyes pyr' sp., Pyrus communis.

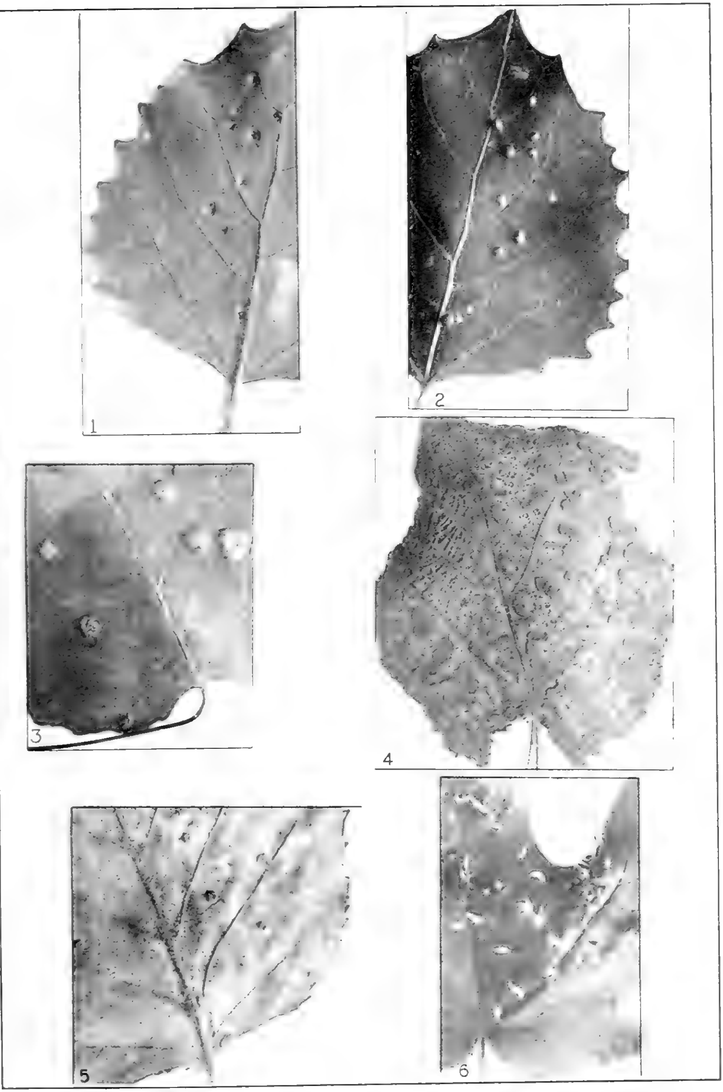


PLATE C.

1. Eriophyes sp., (under surface) Populus grandidentata.
2. Eriophyes sp., (upper surface) Populus grandidentata.
3. Eriophyes sp., Populus tremuloides.
4. Eriophyes sp., Tilia Europea.
5. Eriophyes sp., Betula papyrifera.
6. Phlœoptes aceris, Acer saccharinum.

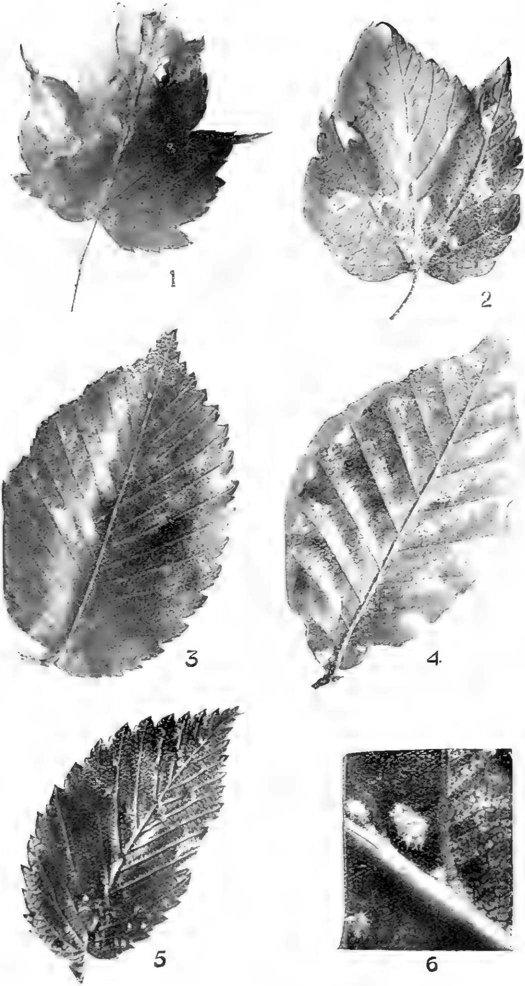


PLATE D.

1. Sugar Maple Pink Frost Gall. *Eriophyes sp.*
2. Manitoba Maple Frost Gall. *Eriophyes sp.*
3. Rock Elm Frst Gall. *Eriophyes sp.*
4. Beech Frost Gall. *Eriophyes sp.*
5. Elm Mite Gall. *Eriophyes ulmi.*
6. Elm Mite Gall. Enlarged opening on under surface.

PLATE E.

1. Eriophyes sp., Amelanchier Canadensis.
2. Eriophyes sp., Juglans nigra.
3. Eriophyes sp., Populus italica.
4. Eriophyes sp., Vitis cordifolia.
5. Eriophyes sp., Salix Iragilis.

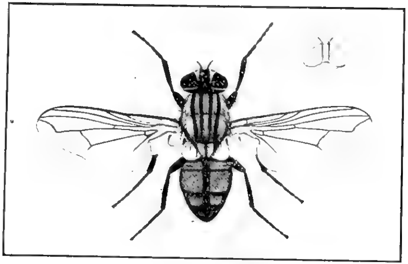


Fig. 1.—The House-Fly, *Musca domestica*, L. Female.

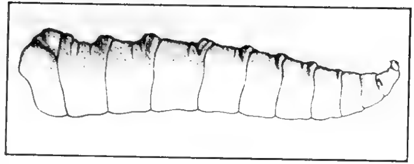


Fig. 3.—Full-grown Larva or "Maggot" of *Musca domestica*.

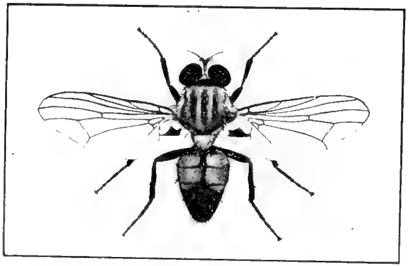


Fig. 2.—The Lesser or Small House-Fly, *Homalomyia canicularis*, L. Male.

Fig. 4.—Colonies of Bacteria obtained by allowing a fly caught in the open to walk over a culture plate.

PLATE F. (See page 36.)

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